

TAXONOMY OF THE NATIVE NORTH AMERICAN
SPECIES OF *SACCHARUM* (POACEAE:
ANDROPOGONEAE)

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ABSTRACT

Saccharum L. consists of about 40 species concentrated in the tropics and subtropics of the world. Five species and one variety are recognized in this revision of the native North American taxa. Recognized taxa include *S. alopecuroideum* (L.) Nutt., *S. baldwinii* Spreng., *S. brevibarbe* (Michx.) Pers. var. *brevibarbe*, *S. brevibarbe* (Michx.) Pers. var. *contortum* (Nutt.) R. Webster, *S. coarctatum* (Fern.) R. Webster, *S. giganteum* (Walt.) Pers. A review of the relevant taxonomic history of the taxa is presented. A comprehensive set of morphological, geographical, and nomenclatural data was collected. A discussion is given on the range and distribution of the 234 characters applied in the taxonomic analysis. The DELTA computer system was used for the analysis and production of a key to the species and comparative species descriptions. Given for each taxon is a representative set of specimen citations and a discussion of diagnostic characters and biological relationships among the recognized species.

RESUMEN

Saccharum L. está formado por cerca de 40 especies concentradas en las zonas tropicales y subtropicales del mundo. En esta revisión de los taxa nativos de Norteamérica se reconocen cinco especies y una variedad. Los taxa reconocidos son: *S. alopecuroideum* (L.) Nutt., *S. baldwinii* Spreng., *S. brevibarbe* (Michx.) Pers. var. *contortum* (Nutt.) R. Webster, *S. coarctatum* (Fern.) R. Webster y *S. giganteum* (Walt.) Pers. Se presenta una revisión de la historia taxonómica de los taxa. Se coleccionó un conjunto extenso de datos morfológicos, geográficos y nomenclaturales. Se hace una discusión del rango y distribución de los 234 caracteres utilizados en el análisis taxonómico. Se empleó el sistema DELTA para el análisis, la elaboración de la clave de especies y para las descripciones comparativas de las especies. De cada taxon se da un conjunto representativo de citas y se hace una discusión de los caracteres diagnósticos y de las relaciones biológicas entre las especies que se reconocen.

INTRODUCTION

North American floristic authors traditionally treated the native species of *Saccharum* L. under *Erianthus* Michx., which was established in *Flora Boreali Americana* (Michaux 1803). Hitchcock (1951) recognized both genera and separated them on the traditional character of presence or absence of the upper lemma awn. That is, *Saccharum* species possess an awned upper lemma, whereas *Erianthus* species lack the awn. For the grasses of South Africa, Chippendall (1955) treated only the introduced species, *S. officinarum* L., but described the genus as awnless or rarely awned. Bor (1960) used the same character in his treatment of Asian grasses to differentiate the genera; however, he listed *Erianthus* species under both genera. South American writers (Burkart et al. 1969; Rosengurtt et al. 1970; Smith et al. 1982) separated the genera on the same character. Bor's (1970) "Gramineae" in *Flora Iranica* recognized only *Saccharum* and submerged *Erianthus* as a section differentiated on the absence of an awn. Taxonomists associated with the sugarcane breeding programs (Dutt & Roa 1950) consistently placed the species in separate genera. In *Grasses of the Soviet Union*, Tsvelev's (1976) separated the genera on presence of an awn and length of the callus hairs. Hsu's (1978) treatment of Taiwanese grasses separated *Erianthus* and *Saccharum* on whether culms are solid, reduction of the upper lemma, and presence of an awn. Finally, Clayton and Renvoize (1986) concluded that placing the awned and unawned species into separate genera was artificial and recognized only *Saccharum*. In the absence of conclusive taxonomic evidence to the contrary, it seems appropriate at the present time to follow the concepts of Clayton and Renvoize (1986), Bor (1970), and Renvoize (1984) and treat *Erianthus* as a synonym of *Saccharum*.

Saccharum consists of about 40 species which mostly occur in the tropics and subtropics of the world. The center of diversity is tropical Asia, with approximately 25 native species occur. There is apparently only one native species in Africa and no species are known to be native to Australia. Four to 10 species occur in North America north of Mexico, excluding the Caribbean and 3 to 7 species are native to South America and Mesoamerica. The taxonomic relationships among the native taxa of *Saccharum* have not been carefully studied nor well-defined. The objective of the present study is to define this relationship for the North American taxa. The introduced species [*S. spontaneum* L., *S. officinarum* L., and *S. ravennae* (L.) P. Beauv.] are not treated here.

This study was based on field studies and loaned specimens from BM, BR, BRI, BRIT, C, CANB, F, GH, ISC, K, L, MICH, MO, NY, PH, and US. The DELTA system (Dallwitz 1980; Dallwitz et al. 1993) was used to gather, analyze, and present the taxonomic data. These procedures are dis-

cussed in previous studies by Webster (1988, 1992) but require a brief statement here. Initially, a list of characters and associated states was constructed to account for taxonomically significant variation within the complex. Classical methods of specimen analysis were used for the recognition of the taxa. Specimens of a recognized taxon were used to record the full range of data for each of the 285 characters. This data together with the authors concepts of species and character reliability were incorporated into the DELTA programs (CONFOR, KEY, & INTKEY) for the production of the identification key and descriptions.

TAXONOMIC HISTORY

The objective of this section is to provide a chronological explanation of the taxonomic development of the group, which begins with Linnaeus's *Species Plantarum* (1753) where *Saccharum* L. and two species, *Andropogon alopecuroides* L. and *Andropogon divaricatus* L., were named. Thirty-five years later Walter (1788) named the taxon *Anthoxanthum giganteum* and created a taxonomic problem which persists today. Andre Michaux (1803) in *Flora Boreali-Americana* defined *Erianthus* Michx. and two species, *E. brevibarbis* Michx. and *E. saccharoides* Michx. Persoon (1805) transferred *E. brevibarbis* and *A. giganteum*, to *Saccharum*; conversely, Muhlenberg (1813) transferred *A. giganteum* to *Erianthus*. Even at this relatively early date there were differences in opinion concerning the relationship between *Erianthus* and *Saccharum*. Elliott's *Sketch of the Botany of South Carolina and Georgia* (1816) contains two new species, *E. contortus* and *E. strictus*, and transfers the epithet *Andropogon alopecuroides* to *Erianthus*. His work was soon followed by Nuttall (1818), who placed *E. strictus*, *E. contortus*, and *E. alopecuroides* in *Saccharum*. Sprengel (1815) made the new combination, *S. strictum* (Host.) Spreng., for an Old World species, making Nuttall's combination [*S. strictum* (Baldw.) Nutt.] illegitimate. Sprengel (1825) provided the name, *S. baldwinii*, for this taxon. Chapman (1860) treated *Andropogon brevibarbis* and *E. contortus* as varieties of *E. alopecuroides*. Between 1895 and 1900 Nash named four new species and one variety of *Erianthus* (*E. smallii*, *E. compactus*, *E. laxus*, *E. tracyi*, and *E. alopecuroides* var. *hirsutis*). Fernald (1943) concluded that the name *brevibarbis* had been misapplied and named a new species and two varieties (*E. coarctatus*, *E. coarctatus* var. *elliottianus*, and *E. saccharoides* var. *compactus*).

As with many species complexes of flowering plants the most useful taxonomic information is contained in the regional floristic treatments. The earliest significant treatment is Mohr (1901), who recognized five species (*E. alopecuroides*, *E. saccharoides*, *E. brevibarbis*, *E. strictus*, and *E. smallii*), but does not give a key. In that work, *E. giganteum* and *E. saccharoides* are

nomenclaturally confused, the concept of *E. brevibarbis* is incorrect, as is the relationship between *E. smallii* and *E. contortus*. Nash's (1903, 1913) treatments in Small's manual follows these concepts and recognizes his four new species. Albert Hitchcock contributed the Gramineae for the 1933 3rd edition of Small's manual, where five species (*E. brevibarbis*, *E. contortus*, *E. divaricatus*, *E. saccharoides*, and *E. strictus*) were recognized. Nash's taxa were placed in synonymy. Most of the morphological and nomenclatural confusion occurring in Mohr (1901) was duplicated in Hitchcock's (1933) treatment. Hitchcock (1935) presented a similar morphological treatment but uses the name *E. alopecuroides* in place of *E. divaricatus*, and *E. giganteus* in place of *E. saccharoides*. Fernald (1950) treatment incorporated his clarification (Fernald 1943) of *E. brevibarbis* and recognized six species and one variety (*E. giganteus* var. *compactus*). Hitchcock (1951) followed Fernald's concepts and recognized the same taxa. Mukherjee (1958) presented a worldwide revision of *Erianthus* and recognized eight North American species; however, his conclusions were not based on a detailed study of New World material or collections. Radford et al. (1964) recognized five species and apparently discounted or did not appreciate Fernald's contributions. Their treatment is similar to Hitchcock (1935). Strausb Augh and Core (1970) in their flora of West Virginia included one species (*E. alopecuroides*). Correll and Johnston (1970) follow the concepts presented in Mukherjee (1958), and provide a key to four species, which does not account for the known morphological variation within the complex. Long and Lakela (1971) recognizes only one species, *E. giganteus*, as occurring in tropical Florida. A recent explanation of the nomenclature of *E. giganteus* is given in Gandi and Dutton (1993). Gould (1975) followed Hitchcock's (1951) morphological concepts, and reported five species from Texas, and included a key to the species. Allen (1975) uses Mukherjee (1958) as a reference and reports five species for Louisiana. The most complete morphological data for these species is given in Godfrey and Wooten (1979), where five species are listed; however, their species concepts appear identical to Hitchcock (1935).

CHARACTER VARIATION

The purpose of this section is to define characters used in this study and to discuss the range in variation found among the taxa as compared to all grasses. Of the 234 characters considered in this study, 63 apply to vegetative structures, 49 describe the inflorescence, 103 describe spikelet parts, and 19 apply to topics other than morphology (eg. geography and ecology). Characters common to all taxa are applicable at the generic level.

All taxa are hermaphroditic, in that, no sexual differences exist among the spikelets of a plant. This is an exclusively perennial complex, lacking stolons, but with distinctly compacted rhizomes which produces a knotty

crown. Rhizomes are relatively short, except in *S. alopecuroideum*, and soon become erect to produce a new flowering culm. Leaves of the rhizomes are glabrous and striate. Flowering culms are not lignified, not caespitose, erect, never root at the lower nodes, and typically vary from 0.8 to 2.5 meters in height. The shortest species is *S. baldwinii* and the tallest *S. giganteum*, however, height overlaps exist for these taxa. Each flowering culm is unbranched, terminates in a solitary inflorescence, and consists of 4–8 nodes. Culm nodes are not swollen and may be glabrous as in *S. baldwinii* or long pilose as in *S. alopecuroideum*. Internodes are glabrous, smooth, and hollow at maturity; however, immature internodes may be solid to spongy. Glaucous internodes occasionally occur in *S. alopecuroideum*, otherwise viscid or glaucous internodes do not occur in this complex. A basal cluster of leaves is not present, as all leaves originate from flowering culm nodes.

Pronounced leaf auricles are not present; however, minute sheath auricles, measuring 0.3–1.0 mm long, are present in *S. baldwinii* and *S. coarctatum*. Leaf sheaths are smooth, closed, rounded on the back, do not overlap, and the length has no diagnostic value. Sheaths are typically glabrous but are hairy in some immature specimens of *S. giganteum*. The apex of the sheath is ciliate in *S. alopecuroideum* and *S. giganteum*, but otherwise undifferentiated. The ligule is a rounded, ciliate membrane, measuring 1–6 (usually 2–3) mm long, and cannot be relied on to differentiate among the taxa. However, *Saccharum giganteum* is the only taxon with a differentiated collar with long pilose hairs. Leaf blades are linear, flat, lax, flexuous, and spreading in all taxa. Shorter and narrower blades are found in *S. baldwinii* and *S. giganteum*; however, range overlaps exist for all taxa and these characters have little or no diagnostic value. Surface of leaf blades are adaxially and abaxially smooth in all taxa and the margins are smooth or minutely scabrous. At maturity, *S. giganteum* is the only species which may possess hairy (pilose) leaf blades. Margins of the blades are flat and not thickened; however, the midvein of the blade is pronounced or swollen in all taxa. Significant variation was not found in shape of the acuminate apex and truncate base. Morphology of the prophyllum was not included.

The peduncle (stalk of the inflorescence) is typically elongate, but relatively short in *S. baldwinii* and *S. coarctatum*. It is hairy, especially at the apex, in *S. alopecuroideum* and *S. giganteum*, but otherwise glabrous and undifferentiated. The inflorescence is a terminal, fully exerted panicle varying from linear, oblong, to lanceolate. Inflorescence shape is determined by the amount and length of hairs associated with the callus. In *S. baldwinii*, the callus hairs are essentially absent and the inflorescence is narrow and linear; whereas, in *S. alopecuroideum* and *S. giganteum* the hairs are long, spread at maturity, and the inflorescence is oblong to lanceolate. *Saccharum brevibarbe* and *S. coarctatum* are intermediate between these forms. The low-

ermost inflorescence node is differentiated only in the sense that it is hairy in some taxa. The main axis of the inflorescence is present and relatively stout. There are no taxonomically significant differences among the taxa based on length of the main axis. The amount of hairs on the main axis varies from densely hairy to essentially glabrous, and is positively correlated with the amount of hairs associated with the callus. Primary branches of the inflorescence potentially originate at all points on the main axis (that is, quaquaversal and not secund or distichous), have appressed secondary branches with distichous spikelets, and are not whorled. The primary branches are best described as appressed; however, presence of dense inflorescence hairs produces some spreading and at anthesis the branches spread and produce a slightly open inflorescence. Number of primary branches is difficult to determine, but varies from 8–30, and was not given high taxonomic significance in this study. Primary branches are straight, smooth, and glabrous or hairy. Hairiness of the branches tends to occur in lines and is correlated with the amount of hairs on the main axis. Length of the branches varies between 2–18 cm with the rachis internode slightly longer than the pedicel, but shorter than the spikelets.

Pedicels are straight, not distinctly grooved, smooth, truncate, and glabrous or hairy. Hairiness of the pedicels is positively correlated with the amount of hairs associated with the callus and main axis. Disarticulation is identical for all taxa with distinct points at branch internodes and at the base of the pedicelled spikelet. Morphological differences associated with the callus hairs are taxonomically significant in this complex. Other than the presence of hairs, the callus is undifferentiated. The hairs are completely absent or sparse in *S. baldwinii* and dense and long in *S. alopecuroideum* and *S. giganteum*. Other taxa are intermediate between these extremes. Color of the hairs is diagnostically important. Silvery hairs are characteristic of *S. alopecuroideum*, whereas the hairs of the remaining taxa vary from white to brown. The single most reliable character for distinguishing among the taxa is the length of the callus hairs relative to spikelet length. They are relatively short in *S. baldwinii*, long in *S. alopecuroideum* and *S. giganteum* (but of different color), and intermediate in *S. brevibarbe* and *S. coarctatum*.

Cleistogamous spikelets were not observed in the taxa; however, certain South American taxa are characterized by this feature. Spikelets are paired, abaxial, slightly overlapping, not embedded in the rachis, evenly distributed on the rachis, and either heteromorphic or homomorphic. Here, heteromorphism is a result of differences in the amount of hairs. Except for *S. baldwinii*, it is typical for the glumes of the sessile spikelet to be glabrous or not as densely hairy as the pedicellate spikelet. The sessile and pedicellate spikelets are otherwise identical. Spikelet color has minor diagnostic importance and cannot be used with confidence to distinguish among the

taxa. *Saccharum baldwinii* and *S. coarctatum* are dark brown in color, whereas the other taxa are best described as straw-colored. Spikelets are dorsiventrally compressed, lanceolate, and attenuate at the base. Frequently the second glume is slightly keeled. Spikelet length and width are of minor diagnostic value. The smallest spikelets are associated with species characterized by long callus hairs. These species may rely on wind dispersal of seeds, whereas species with larger spikelets and shorter hairs may depend more on dispersal by water. For example, *S. baldwinii* has relatively short hairs or completely lacks hairs and grows in shaded stream bottoms closely associated with moving water; whereas, *S. alopecuroideum* with long hairs and relatively smaller spikelets inhabits open areas not necessarily associated with water.

The first glume is 5 nerved, encircles the spikelet base, and equals spikelet length, spikelet shape, and length of the second glume. It is cartilaginous in texture and slightly denser than the second glume. The surface is smooth, except in *S. baldwinii* where it is scabrous. The degree of hairiness of the first glume is correlated with the amount of hairs associated with the callus. In *S. alopecuroideum* and *S. giganteum* the first glume is hairy, whereas in *S. baldwinii* it is glabrous. Apex of the first glume is acuminate and muticous for all taxa; however, commonly the apex is minutely notched or emarginate. The rachilla is not pronounced in the complex. The second glume is 3 or 5 nerved, essentially smooth, not ciliate, equals spikelet length and shape, acuminate, and muticous. The lower floret consists of a well-developed lemma, with the palea and other structures missing. The lower lemma is glabrous, hyaline, lanceolate, smooth, not keeled, acuminate, and muticous. It usually lacks distinct nerves in *S. alopecuroideum*, *S. brevibarbe*, and *S. giganteum*, whereas, in *S. baldwinii* and *S. coarctatum* the lower lemma is 2–3-nerved. Rarely, in these latter species the central nerve extends into a pronounced awn. Length of the lower lemma ranges from 3–8 mm and is of minor diagnostic value, as is the relative length to the upper lemma. The upper lemma is lanceolate, hyaline, smooth, glabrous, acuminate, awned, and commonly purple at maturity. Differences exist among the taxa on length of the upper lemma, however, these differences are correlated with overall spikelet length. Number of nerves on the upper lemma ranges from 1–3. *Saccharum alopecuroideum* and *S. giganteum* are 1-nerved, whereas the others are distinctly 3-nerved. In those taxa with a straight awn the upper lemma apex is entire, whereas taxa with a coiled awn have a bifid apex. The bifid apex produces lateral lobes which measure approximately 2 mm long.

Morphology of the callus and upper lemma awn are taxonomically the most significant and reliable characters for the complex. This awn is minutely scabrous and glabrous. Length is variable and is of limited taxo-

onomic value. The awn may be basally flat or terete, spiraled or not, and straight or geniculate. These three characters are all interrelated. That is, a flattened awn results in spiraling and spiraling frequently produces geniculation. A germination flap is not pronounced in the complex. The palea of the upper floret is hyaline, well-developed, and about 1/2 the length of the upper lemma. It is ovate, smooth, and acute or cleft at the apex. Lodicules are pronounced and measure about 1 mm in length. The taxonomic value of this structure lies in whether the nerves extend into hair-like projections, which is best illustrated in mature specimens of *S. coarctatum*. Taxa of the complex have 2 stamens, whereas the introduced species, *S. ravennae*, a native of southern Europe, is characterized by 3. Anthers are red to purple, about 1.7 mm long, and lack taxonomic significance. The caryopsis has a punctiform hilum and the length is correlated with spikelet length. The embryo measures about 1/2 the length of the caryopsis. Base chromosome number for the complex is 10. Cytology of the complex is the topic of a separate study (Burner & Webster 1994). Plants flower mostly from June to November, grow in helophytic to mesophytic conditions, and are locally common throughout the southeastern United States.

KEY TO THE SPECIES

1. Awn of upper lemma basally spiraled 2
 2. Callus hairs equal to or shorter than the spikelet; callus hairs white to brown; callus hairs less than 7 mm long; main axis sparsely hairy *S. brevibarbe*
 2. Callus hairs longer than the spikelet; callus hairs silvery; callus hairs more than 7 mm long; main axis densely hairy *S. alopecuroideum*
1. Awn of upper lemma not basally spiraled 3
 3. Callus hairs longer than the spikelet; lemma of upper floret 1-nerved; lowermost inflorescence node densely hairy *S. giganteum*
 3. Callus hairs equal to or shorter than the spikelet; lemma of upper floret 3-nerved; lowermost inflorescence node not densely hairy 4
 4. Callus hairs absent or up to 2 mm long; primary branches glabrous; inflorescence 10–25 mm wide *S. baldwinii*
 4. Callus hairs more than 2 mm long; primary branches hairy; inflorescence more than 25 mm wide 5
 5. Awn of upper lemma basally flattened; lemma of lower floret not distinctly nerved; upper lemma 0.9–1.0 times the length of the lower lemma; leaves sheaths without distinct auricles *S. brevibarbe*
 5. Awn of upper lemma basally terete; lemma of lower floret typically 3-nerved; upper lemma 0.7–0.8 times the length of the lower lemma; leaves with minute sheath auricles *S. coarctatum*

TAXONOMIC TREATMENT

Saccharum alopecuroideum (L.) Nutt., Gen. Pl. 1:60. 1818. *Andropogon alopecuroides* L., Sp. Pl. 1045. 1753. *Erianthus alopecuroides* (L.) Elliott, Sketch Bot. S. Carolina 1:38. 1816. TYPE: VIRGINIA, Clayton 601 (HOLOTYPE: LINN 1211.9, photograph seen). Fig. 1.

Andropogon divaricatus L., Sp. Pl. 1045. 1753. *Erianthus divaricatus* (L.) Hitchc., Contr. U.S. Natl. Herb. 12:125. 1908. TYPE: VIRGINIA, Clayton 70 (HOLOTYPE: LINN, not viewed).

Erianthus tracyi Nash, Bull. Torrey Bot. Club 24:37. 1897. TYPE: MISSISSIPPI, Starkville, Tracy s.n. (HOLOTYPE: NY!; ISOTYPE: US!).

Erianthus alopecuroides (L.) Elliott var. *hirsutus* Nash in Small, Fl. SE U.S. 55. 1903. TYPE: FLORIDA, Chapman s.n. (HOLOTYPE: NY!).

Rhizomes with elongate internodes. Flowering culms 10–25 dm tall. Nodes hairy (occ. glabrous at maturity; the hairs usually 7–12 mm long). Internodes solid; occasionally glaucous. Leaves without auricles. Sheaths apically ciliate. Ligule 1–3 mm long. Collar not differentiated; glabrous. Leaf blades 30–60 cm long; 14–28 mm wide; glabrous at maturity. Peduncle 40–60 cm long; hairy (pilose below the inflorescence). Inflorescence oblong to lanceolate; 3–10 cm wide. Lowermost inflorescence node hairy. Main axis 15–34 cm long; densely pilose. Primary branches appressed to the main axis; 3–12 cm long; hairy; ciliate. Rachis internode 3–5 mm long; 0.3 mm wide; hairy. Pedicels 2.5–4 mm long; hairy. Callus hairy; with silvery hairs (frequently tinged in purple). Callus hairs 9–14 mm long; longer than the spikelet. Spikelets heteromorphic; straw-colored; 6–7 mm long; 1.1–1.4 mm wide. First glume 5-nerved; smooth. Second glume 3 or 5-nerved. Lemma of lower floret 4.8–5.6 mm long nerveless or 1-nerved. Upper floret 0.6–0.8 times the length of the lower floret. Lemma or of upper floret 4–4.6 mm long; 1-nerved; bifid. Lateral lobes of upper lemma 1.8–2.2 mm long (ciliate). Awn of upper lemma 14–20 mm long; basally flattened; basally spiraled. Lodicules with nerves not extending into hair-like projections (occ. with a few short hairs).

Saccharum alopecuroideum occurs occasionally over a wide area of the southeastern United States, but is evidently rare or non-existent on the sandy coastal plain. Its western geographic limit is eastern Texas and Oklahoma, whereas the northern limit is southern Missouri, Illinois, Indiana to New Jersey. In addition, there is a paucity of specimens from southern Florida and the higher elevations of the Appalachians. It is common to find *S. alopecuroideum* associated with *S. giganteum*; however, *S. giganteum* occupies low moist areas and *S. alopecuroideum* exists on the dry clay upper slopes.

Vegetatively, *S. alopecuroideum* is differentiated from the other species by the presence of pronounced elongate rhizomes up to three inches long. The rhizomes of other members of this complex are short with few nodes and immediately produce an erect flowering culm. Additional diagnostic vegetative characters include the presence of long, white and pilose hairs on the culm nodes and base of the leaf blades. This hair type also occurs at the peduncle apex, main axis, and callus. Presence of silvery callus hairs exceeding spikelet length and a twisted geniculate upper lemma awn differ-

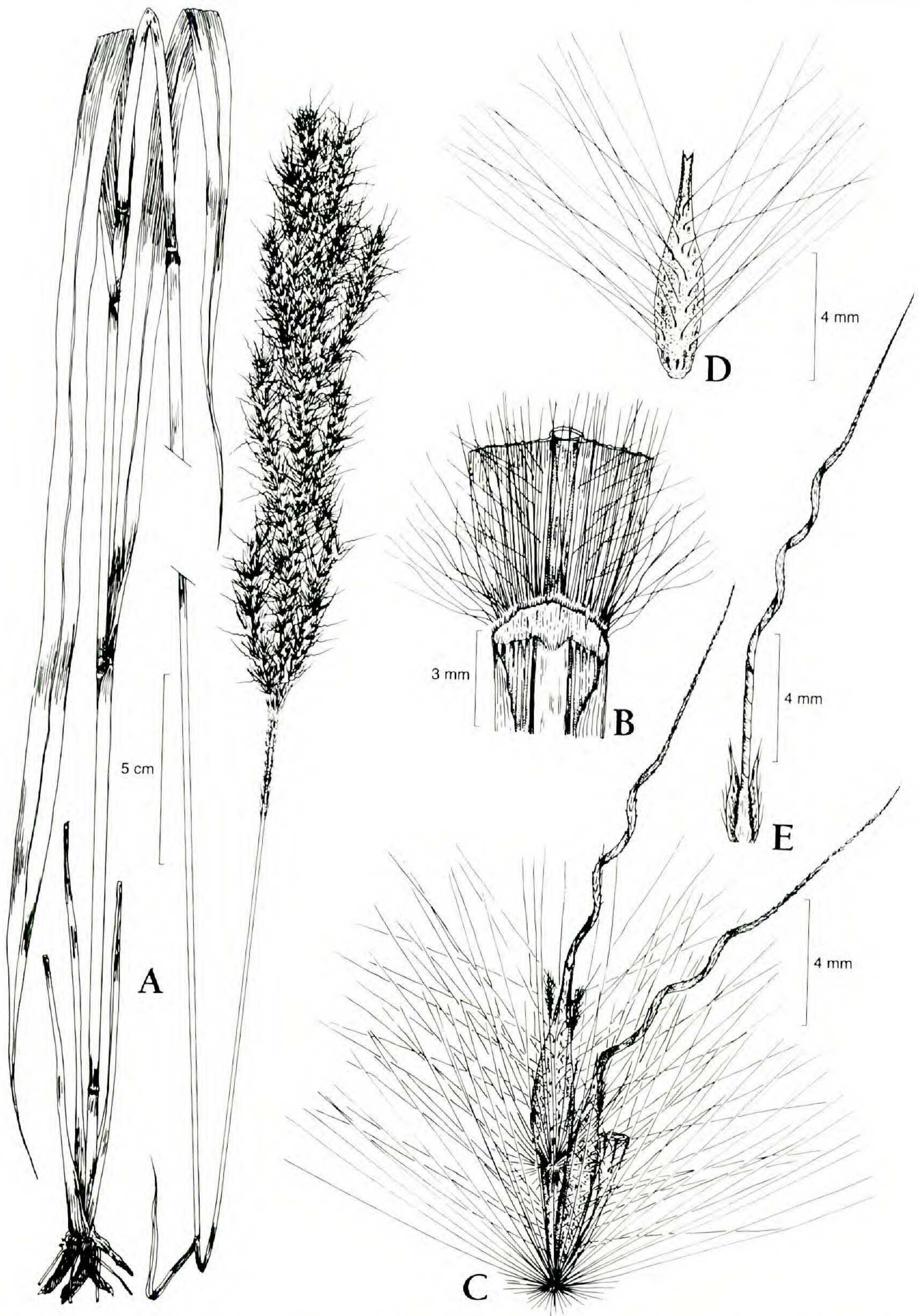


FIG. 1. *Saccharum alopecuroideum*. A. Habit, B. Ligule, C. Spikelet, pair, D. First Glume, E. Upper Lemma Awn.

entiates this species from others of the group. *Saccharum alopecuroideum* is most similar to *S. giganteum*, but easily distinguished on the presence of the spiraled upper lemma awn. Specimens with intermediate characteristics are rarely encountered.

Representative specimens examined. **ALABAMA:** Cherokee Co.: 2 mi N Leesburg, 14 Sep 1968, *Kral* 33376 (BRIT, C). Lawrence Co.: 8.8 mi S Meulten, 23 Sep 1970, *Kral s.n.* (MO). Lee Co.: 14 Oct 1897, *Earle & Baker s.n.* (MO). Auburn, 25 Sep 1897, *Earle & Baker s.n.* (MICH). Marengo Co.: 3.5 mi N Dixon's Mill on US 43, 7 Oct 1967, *Kral* 29585 (BRIT). Shelby Co.: 1 mi E of Harpersville by U.S. 231, 1 Oct 1971, *Kral* 44615 (NY). Winston Co.: border of fields, 13 Sep 1897, *Eggert s.n.* (GH, MO). **ARKANSAS:** Carroll Co.: Eureka Springs, 24 Sep 1913, *Palmer* 4470 (MO). Hot Springs Co.: P.O. Malvern, *Demaree* 34477 (GH). Izard Co.: 3 mi S of Brandenburg, 24 Sep 1963, *Robinson* 2147 (NY). Jefferson Co.: P.O. Pine Bluff, 1 Oct 1942, *Demaree* 24038 (NY). Lawrence Co.: U.S. 62 between Imboden & Ravenden, 10 Apr 1963, *Robinson* 2324 (NY). Miller Co.: Texarkana, 17 Oct 1894, *Letterman s.n.* (BM). Yell Co.: around Mt. Nebo, 30 Aug 1939, *Demaree* 20545a (MO, NY). **FLORIDA:** Leon Co.: near Tallahassee, *Berr s.n.* (NY). **GEORGIA:** Fulton Co.: College Park, Ga., 10 Oct 1963, *Schallert* 573 (C). Walker Co.: Lula Falls at Lookout Mt., 28 Aug 1883 (NY). **ILLINOIS:** Jackson Co.: 14 Sep 1878, *French s.n.* (F). 2.6 mi S of Gorham, 26 Sep 1956, *Thieret* 2760 (F). Saline Co.: 2 mi NW of Herod, 7 Oct 1949, *Fuller* 14927 (F). **INDIANA:** Crawford Co.: 4 1/2 mi SE of Taswell, 1 Sep 1938, *Tryon, Jr.* 4194 (BRIT). **KENTUCKY:** Rowan Co.: Rt. 1274 S of Clearfield, 16 Sep 1987, *Cusick & Hammer* 27056 (NY). Warren Co.: Green River, Young's Ferry, 10 Sep 1892, *Price s.n.* (MO). **MISSISSIPPI:** Jackson Co.: Ocean Springs, Miss., 17 Oct 1898, *Tracy* 4761 (F, MICH, NY). **MISSOURI:** Barry Co.: T22, R27W, NW 1/4 Sec. 35, 8 Sep 1979, *Hornberger* 842 (MO). Butler Co.: near Rombauer, 2 Sep 1938, *Steyermark* 6414 (F, MO). Carter Co.: Clubhouse, 11 Sep 1897, *Trelease s.n.* (MO). Christian Co.: 21 Sep 1905, *Bush* 3337 (GH, MO, NY). Douglas Co.: T25N, R13W, Sect. 9, 27 Oct 1982, *DeLozier* 781 (MO). Dunklin Co.: Campbell Mo., 14 Sep 1893, *Bush s.n.* (MO); throughout SE Mo., 24 Nov 1892, *Bush s.n.* (MO). Ozark Co.: near Tecumseh, 8 Oct 1927, *Palmer* 32942 (GH). Ripley Co.: Little Black River between Greenville ford and Pennington ford, 1 Sep 1946, *Steyermark* 63964 (F). Shannon Co.: 3 mi SW of Midridge, T30N, R3W, Sect. 10, 27 Sep 1936, *Steyermark* 20155 (MO). **NEW JERSEY:** Hudson Co.: near the Hudson river at the base of the Palisades, 8 Nov 1936, *Beals s.n.* (GH, PH); Palisades at Coytesville, 3 Sep 1916, *Wiegmann* 1709 (GH). **NORTH CAROLINA:** Catawba Co.: 5 mi ESE of US 64-70, on Startown Rd., 14 Sep 1978, *Solomon* 3956 (MO). Forsyth Co.: 14 Sep 1941, *Schallert s.n.* (NY). Macon Co.: 5 mi S of Franklin, 22 Aug 1936, *Correll* 6678 (GH). Moore Co.: 7.8 mi E of Carthage, 24 Oct 1936, *Correll* 7001 (MICH). Orange Co.: 3 mi E of Hillsboro, 29 Sep 1939, *Blomquist* 10945 (NY, PH). Robeson Co.: 4.5 mi SSW of St. Pauls along Co. 1765, 10 Oct 1964, *Britt* 3064 (C, GH, MICH, NY). Rowan Co.: S bank of Yadkin River, E of U.S. 29 bridge, 11 Oct 1956, *Horton* 522 (NY). Stokes Co.: 3 mi SW of King, *Radford* 41268 (MICH); Cascades, 22 Aug 1938, *Blomquist* 10,423 (F); 2.2 mi N of Moores Springs, 2 Oct 1958, *Radford* 41382 (BRIT). Yadkin Co.: 6 mi E of Yadkinville, highway 421, 6 Sep 1937, *Blomquist & Anderson* 9870 (GH). **OKLAHOMA:** Pushmataha Co.: 1 mi N and 1/2 W of Honobia, 9 Aug 1948, *Waterfall* 8532 (GH). **SOUTH CAROLINA:** Anderson Co.: Anderson, 24 Sep 1919, *Davis s.n.* (MO). Greenwood Co.: Greenwood, 22 Oct 1913, *E.B.B.* 3310 (PH). Lexington Co.: US. 378, 4 mi W of Lexington, 5 Oct 1957, *Radford* 29876 (GH). Orangeburg Co.: Eutawville, 9 Sep 1939, *Godfrey* 8198 (F, GH, MO, NY, PH). **TENNESSEE:** Anderson Co.: 30 Sep 1934, *Jennison* 3336 (PH).

Blount Co.: 4 mi N of Tallahassee alongside U.S. 129, 17 Sep 1964, *Thomas 33216* (BRIT). Campbell Co.: near Norris Lake basin, 30 Sep 1934, *Underwood 1378* (NY). Carroll Co.: 2 mi SE of Hollow Rock Jc., 27 Aug 1922, *Svenson 452* (GH). Cocke Co.: between Paint Rock and Del Rio, 12 Sep 1897, *Kearney, Jr. 939* (MO). Grainger Co.: Thorn Hill, 31 Aug 1847, *Moldenke 19347* (NY, PH). Knox Co.: Cherokee Bluffs, Knoxville, 18 Sep 1928, *Anderson 1098* (GH); top of hill at Mr. Beane place out beyond U.T. farm, 7 Oct 1937, (MO). Macon Co.: few mi E of Beech Bottom, 14 Oct 1968, *Rogers 42914* (NY). Montgomery Co.: Adams, Sep 1927, *Rhoades s.n.* (GH). TEXAS: Gregg Co.: summer of 1941, *York s.n.* (GH). Rusk Co.: 6.5 mi NW of Tatum, 14 Oct 1962, *Correll 26303*. VIRGINIA: Albemarle Co.: 7 mi SE of the Monticello mansion, *Wieboldt M-675* (PH). Brunswick Co.: Rattlesnake Creek, at old Clippers Mill, S.W. of Triplett, 13 Sep 1944, *Fernald & Lewis 14690* (GH, PH). Dickenson Co.: 28 Aug 1942, *Carr 1070* (GH).

Saccharum baldwinii Spreng., *Syst. Veg.* 1:282. 1825. *Saccharum strictum* (Baldw.) Nutt., *Gen. Pl.* 1:60. 1818, non Sprengel (1815). *Erianthus strictus* Baldw., in Elliott, *Sketch Bot. S. Carolina* 1:39. 1816. TYPE: GEORGIA. Savannah, *Baldwin s.n.* (HOLOTYPE: PH!). Fig. 2.

Pollinia dura Trin., *Acad. St. Petersburg. Mem. VI. Sci. Nat.* 2:91. 1836. *Andropogon durus* (Trin.) Steud., *Nom. Bot. ed. 2.* 1:91. 1840. TYPE: CAROLINA (not located).

Rhizomes with compacted nodes. Flowering culms 9–18 dm tall. Nodes glabrous or minutely pubescent (white hairs ca. 0.5 mm long). Internodes spongy or hollow; neither viscid nor glaucous. Leaves with sheath auricles. Auricles 0.5–1 mm long. Sheaths not ciliate. Ligule 1–3 mm long. Collar not differentiated; glabrous. Leaf blades 18–60 cm long; 5–12 mm wide; glabrous on the upper surface. Peduncle 30–40 cm long; glabrous. Inflorescence linear; 10–25 mm wide. Lowermost inflorescence node smooth. Main axis 10–35 cm long; glabrous or sparsely hairy. Primary branches appressed to the main axis; 6–18 cm long; glabrous; the margins glabrous. Rachis internode 3–5 mm long; 0.3–0.4 mm wide; glabrous. Pedicels 3–5 mm long; glabrous. Callus glabrous or hairy. Callus hairs straw-colored; 0–2 mm long; shorter than the spikelet. Spikelets brown; 7–10 mm long; 1.1–1.5 mm wide. First glume 5-nerved; scabrous. Second glume 3-nerved. Lemma of lower floret 6–8 mm long; 2-nerved. Upper floret 0.9–1 times the length of the lower floret. Lemma of upper floret 5.5–8 mm long; 3-nerved; entire. Awn of upper lemma 17–24 mm long; basally terete; not basally spiraled. Lodicules with nerves extending into hair-like projections.

Nuttall (1818) was evidently unaware of Sprengel's (1815) earlier name in *Saccharum*. Since North American authors consistently placed this taxon in *Erianthus*, a nomenclatural conflict has not existed. Acceptance of *Saccharum*, in the present study, necessitates the use of Sprengel's (1825) combination.

Saccharum baldwinii occurs throughout the southeastern United States, but is rare or completely absent from higher elevations of the Appalachians. Its western geographic limit is eastern Texas and Arkansas, and the north-

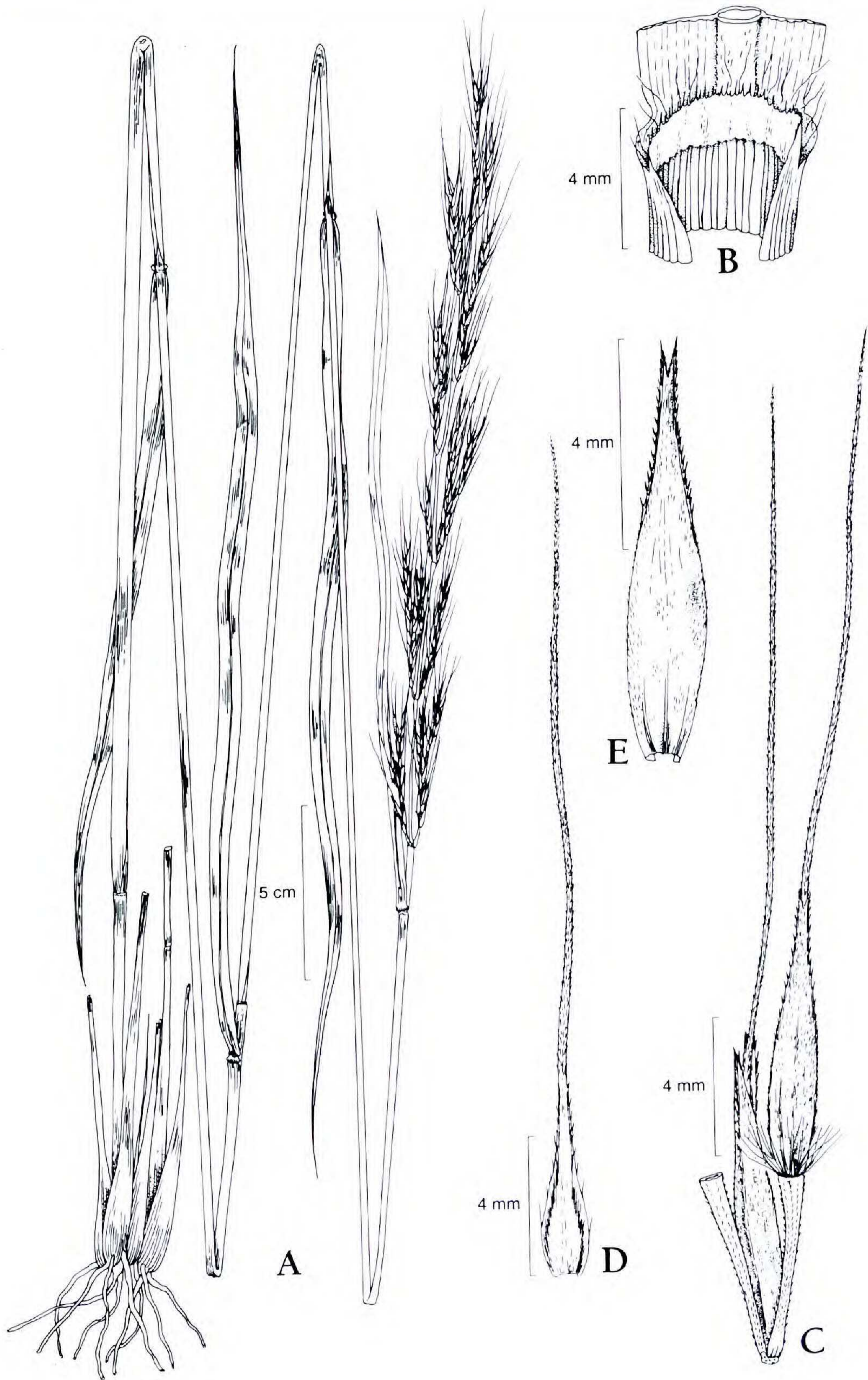


FIG. 2. *Saccharum baldwinii*. A. Habit, B. Ligule, C. Spikelet pair, D. First Glume, E. Upper Lemma and awn.

ern limit is southern Missouri, Tennessee, to northern Virginia. It commonly occurs in sandy shaded river and stream bottoms. Other members of the complex inhabit open wet or seasonally wet areas as well as forest margins where moisture is not a limiting factor. Because of these limiting ecological factors, *S. baldwinii* is not as common as other members of this complex. Vegetative characters that are important in distinguishing *S. baldwinii* include culm height, absence of culm hairs, and auricle shape. Typically, specimens of *S. baldwinii* are much shorter than other members of the complex. In addition, the culm internodes are not thick and the leaf blades are narrow. The most interesting vegetative characteristic is the presence of minute sheath auricles which are ovate and measure about 1 mm in length. Significant characteristics of the inflorescence include the complete lack of pilose hairs, a narrow inflorescence, and homomorphic spikelets. The narrow inflorescence is correlated with the lack of hairs. That is, the long inflorescence hairs of *S. alopecuroideum* and *S. giganteum* result in a wide inflorescence. Significant spikelet characters include glabrous spikelets and a straight upper lemma awn. The most morphologically similar species to *S. baldwinii* is *S. coarctatum*.

Representative specimens examined. **ALABAMA:** Autauga Co.: 1 mi NE of Autaugaville, 24 Sep 1934, *Harper* 3268 (GH, MO, NY, PH). Tuscalosa Co.: Hurricane Creek, 24 Oct 1908, *Harper* 136 (F, GH, MO, NY). **ARKANSAS:** Clay Co.: P.O. Corning, 8–25–1939, *Demaree* 20330 (MO, NY); N Knobell, 21 Aug 1896, *Eggert s.n.* (ISC, MO). Hempstead Co.: near McNab, 4 Oct 1923, *Greenman* 4385 (MO). Lonoke Co.: Carlisle, 3 Oct 1931, *Demaree* 8401 (GH, MO, NY, BM). Miller Co.: Texarkana, Pine Woods, 20 Oct 1894, *Litterman* 9 (MO). Pulaski Co.: Sep 1886, *Hasse s.n.* (NY); Aug 1885, *Hasse s.n.* (F). **FLORIDA:** 1879, *Curtiss s.n.* (F). Baker Co.: old field and pasture, Sep 1920, *King & McRainey* 2695 (PH). Columbia Co.: Osceola National Forest, 2 Nov 1981, *Correll* 53099 (NY). Gadsden Co.: N of US Hwy 90 bridge, Ochlockenee River, *Kral* 1641 (GH). Manatee Co.: Palmetto, Orange Bend, 23 Sep 1907, *Chase s.n.* (US). Monroe Co.: Ponce de Leon, 7 Oct 1901, *Curtiss* 6936 (GH, MO, NY, US). Walton Co.: 6.7 mi S of Ponce de Leon, 27 Sep 1957, *Kral & Godfrey* 5991 (GH). **GEORGIA:** Berrien Co.: SW of Tifton, 29 Sep 1902, *Harper* 1691 (F, GH, MO, NY, US). McIntosh Co.: Cox, 10 Aug 1975, *Abrattys s.n.* (PH). Richmond Co.: Augusta, 6 Feb 1973, *Baldwin s.n.* (PH). Upson Co.: W of Thomaston, at Pasley Shoals of Flint R., 9 Sep 1947, *Piedmont* 4674 (GH, MICH, PH, US). **LOUISIANA:** Allen Parish: 10 mi W of Kinder, 20 Oct 1940, *Brown & Nyland* 8710 (GH); 1.8 mi E of junct. with La. 26, ca. 3 mi E of Elton, 12 Nov 1960, *Reese* 3986 (F). Cameron Parish: Oberlin, 9 Sep 1898, *Ball* 207 (GH, NY). East Baton Rouge Parish: 5 mi E of Harelson store on Hanel's Ferry road, 9 Oct 1927, *Brown* 1927 (NY, US); Elton, 12 Nov 1960 *Reese* 3986 (F, GH). Evangeline Parish: 4 mi E Barber on La. Hwy 10, Bayou Nezpique, 10 Jun 1960, *Ewab* 19985 (US). Franklin Parish: 4.7 mi NNE of Winnsboro, 19 Sep 1956, *Shinners* 24,653 (GH). Livingston Parish: 4 1/4 mi S of Denham Springs. Section 44., 27 Sep 1966, *Thieret* 24813 (US). Ouachita Parish: Sec. 31 T17N R4E, 3 Oct 1988, *Thomas* 107,586 (MO). Rapides Parish: Alexandria, *Hale s.n.* (PH, US). St. Tammany Parish: Covington, 1832, *Drummon s.n.* (BM); Slidell, 5 Oct 1891, *Langlois s.n.* (NY); Covington, Sulphur Springs, Oct 1919, *Arsene* 11566 (US); 3 mi from Covington, 24 Sep

1913, *s.n.* (US). Tangipahoa Parish: E of Robert, 23 Oct 1946, *Brown & Bell* 8800 (GH). Union Parish: Sec. 20 T2ON, R3E, 28 Sep 1987, *Thomas* 102,051 (NY). Vernon Parish: Oberlin, 9 Sep 1898, *Ball* 207 (US); along Devils Creek, section 4. ca. 5 mi NNW of Temple, 30 Oct 1966, *Thieret* 25199 (US). Winn Parish: along La. 501, 1.4 mi S of Mill, 20 Sep 1981, *Kessler* 1893 (L). **MISSISSIPPI:** Harrison Co.: Nicholson, along Pearl River, 11 Oct 1896, *Kearney Jr.* 365 (NY); Biloxi Kashtaw, 13 Oct 1898, *Tracy* 4672 (GH, NY). Jackson Co.: Vancleave, Ocean Springs, 24 Sep 1953, *Demaree* 34378 (US). Pearl River Co.: 2 mi SW of Picayune, 27 Sep 1966, *Sargent* 8929 (MO); 2 mi W of Picayune, 19 Sep 1967, *Sargent* 9467 (MICH). **MISSOURI:** Dunklin Co.: Campbell, 7 Oct 1910, *Bush* 6384 (GH, MO, NY, US). **NORTH CAROLINA:** Anson Co.: 3 mi S of Ansonville, 18 Sep 1950, *Boyce* 1501 (NY). Columbus Co.: Waccamaw River Bridge on Co. Rt. 1928, 23 Oct 1968, *Leonard & Radford* 2203 (BM, BR, ISC, MICH). Cumberland Co.: along stream and low woods, 16 Aug 1932, *Blomquist* 334 (US); 3 mi E of falcon, Rt. 102, 14 Oct 1951, *Boyce & Fox* 1682 (ISC, US). Harnett Co.: near Dunn, 6 Oct 1933, *Blomquist* 728 (F). Pender Co.: Burgaw, 1 Sep 1938, *Godfrey* 6489 (GH, US); edge of Angola Bay Highway 53, 16 Sep 1937, *Blomquist* 10,088 (GH, NY, PH). **SOUTH CAROLINA:** Georgetown Co.: 5 mi S of Georgetown, 9 Sep 1939, *Godfrey* 8127 (F, GH, MO, NY, US). Orangeburg Co.: 8–19–1905, *Hitchcock* 236 (F, GH, L, MO, NY, US). Williamsburg Co.: 1 mi E of Greeleyville, 22 Aug 1957, *Radford* 28387 (NY); 1.8 mi NE of Greeleyville, 19 Oct 1957, *Radford* 31158 (GH). **TENNESSEE:** Carroll Co.: Hollow Rock Jc., 27 Aug 1922, *Svenson* 463 (GH). Coffee Co.: 15 Oct 1880, *Gettinger s.n.* (ISC, MO); Jul 1886 (NY). Davidson Co.: Nashville, 162 (NY). Madison Co.: Jackson bottoms, Sep 1892, *Bain s.n.* (US); Tullahoma, Sep 1882, *Curtiss s.n.* (GH, US); Tullahoma, Sep 1879, *Gettinger* 3629 (BM, F, ISC, MO, NY, US); SE side of Manchester near jct US 41, 20 Aug 1992, *Kral* 43,672 (BM); Oak barrens N of Manchester, 6 Aug 1938, *Svenson* 8934 (US); Sep 1892, *S.M.B.* 198 (NY). **TEXAS:** Anderson Co.: along Catfish Creek at Palestine, 19 Sep 1971, *Hatch* 1059 (MO); 6 mi NW of Tennessee Colony, 22 Oct 1983, *Hatch* 5080 (MICH). Bowie Co.: Texarkana, 20 Oct 1894, *Letterman s.n.* (NY, BM, PH). Harris Co.: Houston, 1842, *Engelmann s.n.* (GH); Houston, Jun 1841, *Lindheimer s.n.* (MO); Houston Co.: Grapeland, 22 Sep 1917, *Palmer* 12823 (NY). Jefferson Co.: McFadden Beach, 5 Oct 1934, *Cory* 11021 (GH); Forest Lawn Cemetery, Beaumont, 3 Oct 1945 *Cory* 50010 (GH, MICH, NY, US); S of Beaumont, 30 Sep 1940, *Silvens* 6444 (US). Liberty Co.: 2.5 mi E of Rye on Hwy 105, 24 Sep 1966, *Gould* 121005 (US). Upshur Co.: between S.L. & S.W. railroad and the Gilmer to Big Sandy Hwy, 28 Nov 1941, *Moon* 110 (US); 3.3 mi S of New Diana, 15 Sep 1953, *Shinners* 15987 (ISC). **VIRGINIA:** Dinwiddie Co.: W of Winfield's Mill, 13 Oct 1941, *Fernald & Long* 13885 (GH, PH). Greenville Co.: N of Emporia, Three Creek 19 Sep 1938, *Fernald & Long* 9241 (GH, PH). Prince George Co.: SE of Disputanta, 7–20–1938, *Fernald & Long* 8581 (F, GH, MO, PH, US). Southampton Co.: E of Drewryville, Terrapin Ridge, 21 Aug 1938, *Fernald & Long* 8917 (GH, PH); sandy alluvia bottomlands of Three Creek, 14 Sep 1941 *Fernald & Long* 13550 (GH). Sussex Co.: SE of Waverly, 10 Sep 1937, *Fernald & Long* 7299 (GH, NY, PH, US); 2 mi E of Stony Creek, 24 Aug 1938, *Fernald & Long* 8918 (GH, PH). York Co.: NW of Grafton, 18 Sep 1937, *Fernald & Long* 7300 (GH, PH, US).

***Saccharum brevibarbe* (Michx.) Pers., Syn. Pl. 1:103. 1805. *Erianthus brevibarbis* Michx., Fl. Bor.-Amer. 1:55. 1803. *Erianthus alopecuroides* (L.) Elliott var. *brevibarbis* (Michx.) Chapm., Fl. South. U.S. 583. 1860. *Erianthus saccharoides* Michx. subsp. *brevibarbis* (Michx.) Hack., Monogr. Phan. 6:131. 1889. TYPE: TENNESSEE and CAROLINA, *Michaux s.n.* (HOLOTYPE: P, photograph seen). Fig. 3.**

Rhizomes with compacted nodes. Flowering culms 8–25 dm tall. Nodes glabrous or hairy. Internodes hollow. Leaves without auricles. Sheaths not ciliate. Ligule 1–2 mm long. Collar not differentiated; glabrous. Leaf blades mostly 40–60 cm long; 7–25 mm wide; glabrous. Peduncle mostly 45–75 cm long; glabrous (occ. pubescent or minutely pilose). Inflorescence linear or oblong; mostly 4–10 cm wide. Lowermost inflorescence node smooth. Main axis (10–)30–50 cm long; glabrous or sparsely hairy; pilose. Primary branches appressed to the main axis; typically 7–14 cm long; hairy; ciliate. Rachis internode 4–6 mm long; 0.4–0.5 mm wide; hairy. Pedicels 3–4 mm long; hairy. Callus hairy. Callus hairs white to straw-colored; 3–6.5 mm long; shorter than the spikelet. Spikelets heteromorphic; purple or straw-colored; 6.5–10.5 mm long; 1.2–1.5 mm wide. First glume 5-nerved; smooth (scabrous at the apex). Second glume indistinctly 5-nerved. Lemma of lower floret 5.5–8 mm long; nerveless. Upper floret 0.9–1 times the length of the lower floret. Lemma of upper floret 5.5–7.5 mm long; 3-nerved; entire or bifid. Lateral lobes of upper lemma 2–2.5 mm long. Awn of upper lemma 10–22 mm long; basally flattened; basally spiraled or not basally spiraled. Lodicules with nerves extending into hair-like projections or not extending into hair-like projections.

Saccharum brevibarbe occurs throughout the southeastern United States. Its western geographic limit is the pineywoods of east Texas and Oklahoma, with the northern limit from Tennessee to Delaware. Diagnostic features include the presence and relative length of the callus hairs, length of the upper lemma awn, and whether the awn is basally flattened. It is most similar to *S. coarctatum*, but can be distinguished by the above-stated characters. *Erianthus smallii* Nash was described to account for specimens with long (8–10 mm) spikelets and dense hairs associated with the apex of the peduncle and main axis. Examination of type material and numerous similar specimens show continuous variation of these characters; therefore, *E. smallii* is placed as a synonym.

The typical variety is common in central and southern Arkansas, eastern Oklahoma, the pineywoods vegetation region of eastern Texas, and northern Louisiana. Relatively few collections were found in Mississippi, Alabama, and Tennessee. One collection was found in a coastal county of North Carolina. *Saccharum brevibarbe* var. *contortum* (Elliott) R. Webster occurs throughout the range previously given for the species. Both varieties occur in similar habitats. They commonly occur in clay or loamy open or marginal sites that are prone to seasonal flooding; however, seasonal flooding is not a critical factor since this species frequently inhabits well-drained clay slopes.

The varieties differ only in morphology of the lemma awn and corre-

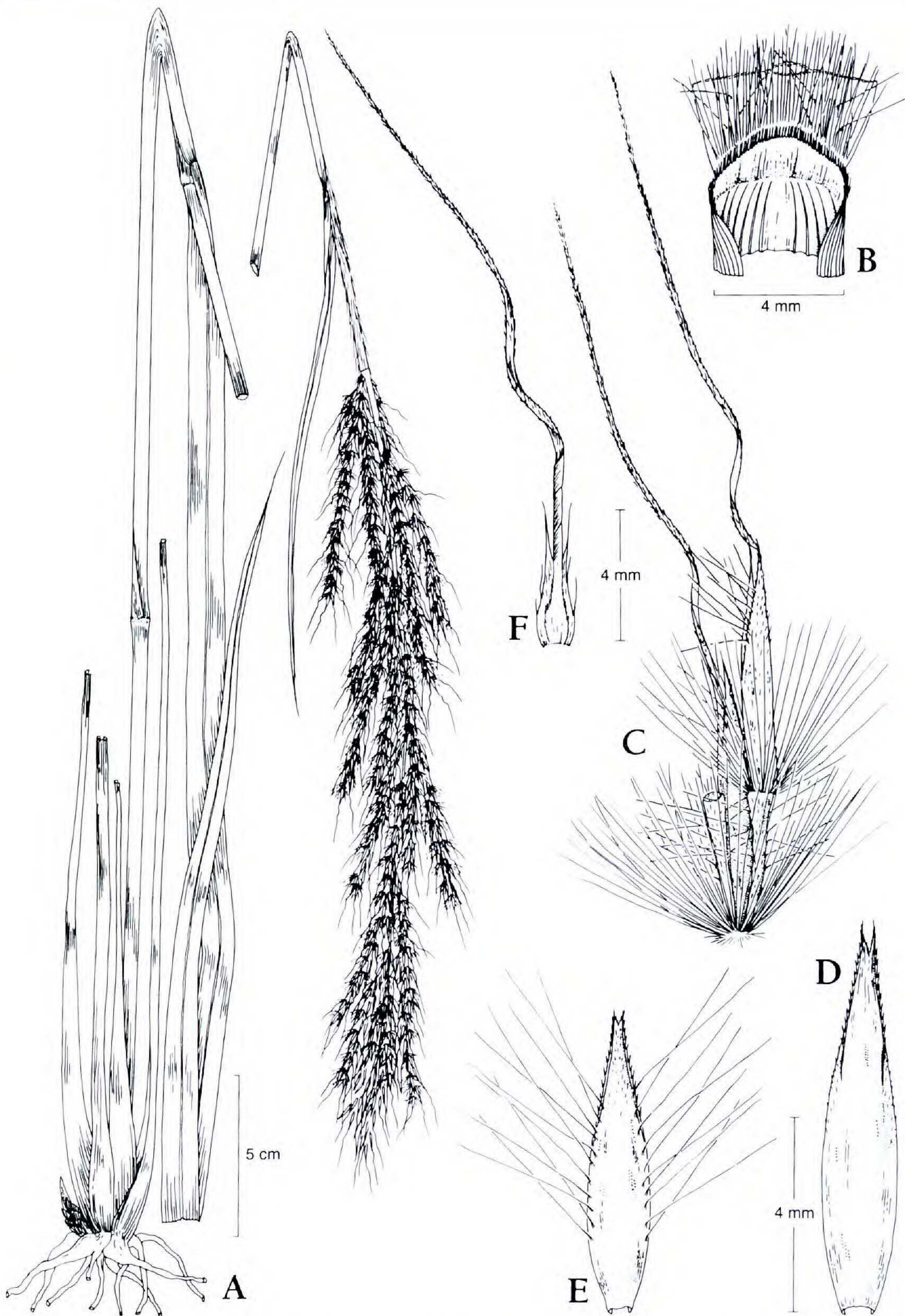


FIG. 3. *Saccharum brevibarbe* var. *contortum*. A. Habit, B. Ligule, C. Spikelet Pair, D. First Glume (upper spikelet), E. First glume (lower spikelet), F. Upper lemma and awn.

lated characters. In variety *contortum* the awn is relatively long, basally flat, geniculate, and tightly coiled or spiraled at the base. Typically 2 to 4 (usually 3) tight spirals occur at the base and 2–4 loose spirals occur above the base. Early in inflorescence development, prior to release from the upper sheath, the awn is not coiled, the apex of the upper lemma is not bifid, and lateral lobes are not present. Once the inflorescence is released from the sheath and as the spikelets mature, the awns quickly develop the spiraling morphology described above. Development of the basal spirals results in tearing the lemma apex from the central awn and producing the lateral lobes characteristic of variety *contortum*. In *S. brevibarbe* var. *brevibarbe* the awn is usually shorter, basally flat, but not tightly spiraled at the base. As a result the lateral lobes are not present. Absence of tight spirals and lateral lobes may be the result of a relatively shorter awn.

The status and interpretation of *E. brevibarbis* Michx. (= *S. brevibarbe* var. *brevibarbe*) has been the source of taxonomic confusion. This problem was addressed in detail by Fernald (1943), who failed to compare this taxon to *E. contortus* Baldw. (= *S. brevibarbe* var. *contortum*). Fernald recognized that Michaux's type of *E. brevibarbis* was morphologically different from the specimens to which the name was being applied. For these specimens he provided the new name, *E. coarctatus* Fernald. The name *E. brevibarbis* was restricted to the type and only one additional specimen (*Demaree* 8228). That concept was followed by Hitchcock (1951).

Michaux's type was clearly illustrated in Fernald (1943) and an original photograph was examined for the present study. Spikelets from the type exhibit callus hairs shorter than the spikelets and the upper lemma awn slightly coiled at the base. Numerous specimens were found showing the same features. These specimens are otherwise identical to specimens previously treated as *E. contortus* Elliott. Intermediate specimens between the taxa are not uncommon. Combining these taxa as varieties of *S. brevibarbe* was considered the most appropriate way to reflect the biological relationship.

KEY TO THE VARIETIES

- Awn of upper lemma basally spiraled; lemma of upper floret bifid with lateral lobes about 2.0 mm long *S. brevibarbe* var. *contortum*
 Awn of upper lemma not basally spiraled; lemma of upper floret entire *S. brevibarbe* var. *brevibarbe*

Saccharum brevibarbe (Michx.) Pers. var. **brevibarbe**

Lemma of upper floret entire. Awn of upper lemma 10–18 mm long; not basally spiraled.

Representative specimens examined. ALABAMA: Russell Co.: 4.5 mi SE Hurtsboro,

12 Sep 1968, *Kral* 33291 (BRIT). ARKANSAS: Ashley Co.: P.O. Hamburg, 27 Sep 1937, *Demaree* 16386 (BRIT, MO). Clark Co.: P.O. Okolona, 11 Oct 1939, *Demaree* 20713 (BRIT). Drew Co.: low waste meadows, P.O. Monticello, 8 Oct 1938, *Demaree* 18287 (BRIT, MO). Garland Co.: Hot Springs National Park, 6 Sep 1934, *Demaree* 11017 (BRIT). Howard Co.: mineral springs, 14 Oct 1932, *Demaree* 9699 (BRIT, GH); mineral springs, 14 Oct 1932, *Demaree* 9744 (BRIT, MO, NY, US). Lafayette Co.: P.O. Lewisville, 19 Oct 1959, *Demaree* 41930 (BRIT). Pike Co.: Murfreesboro, 28 Sep 1932, *Demaree* 9362 (BRIT, GH, MO, NY); near Tokio, 22 Oct 1932, *Demaree* 9939 (BRIT, GH, MO, US). Polk Co.: 20 mi N of De Queen, 30 Nov 1958, *Van Schaack* 3625 (MO). Pulaski Co.: Pulaski Hts., Little Rock, 21 Sep 1931, *Demaree* 8228 (BRIT, GH, MO, NY, US). Saline Co.: P.O. Benton, 6 Sep 1942, *Demaree* 23959 (BRIT, MO). Union Co.: El Dorado, 4 Oct 1953, *Hoiberg* 371 (BRIT); 10 mi NE El Dorado, 7 Oct 1953, *Hoiberg* 378 (BRIT). LOUISIANA: Caddo Parish: about 3 mi S of Longwood, 3 Oct 1965, *Thiret* 21194 (US). Lincoln Parish: 2 mi W of Ruston, 14 Sep 1970, *Hill* 28 (MO). Ouachita Parish: La. 557 just N of Cypress turnoff W of Luna, 7 Oct 1985, *Thomas* 93,843 (MO). MISSISSIPPI: Copiah Co.: P.O. Barlow, 18 Sep 1954, *Demaree* 36190 (BRIT, US). Jackson Co.: Ocean Springs, 23 Sep 1898, *Tracy* 4540 (MICH, MO, US). Oktibbeha Co.: Starkville, 1893, *Tracy* 2228 (US); near Starkville, 27 Sep 1896, *Kearney Jr.* 29 (MO); near Starkville, 29 Sep 1896, *Kearney Jr.* 56 (US). NORTH CAROLINA: Beaufort Co.: 1.4 mi NE of Washington, 12 Oct 1958, *Radford* 42167 (NY). OKLAHOMA: Lefore Co.: near Page, 8 Sep 1913, *Stevens* 2662 (GH, NY, US); Sec. 9–10, T. 3 S., R. 25 E, State Game Preserve, 2 Jul 1930, *Little Jr.*, 501 (US); near Bokhoma, 11 Oct 1937, *Palmer* 44090 (MO). TEXAS: Bowie Co.: Texarkana, Oct 1894, *Letterman s.n.* (MO, NY, PH, US); near Texarkana, Aug 1883, *Letterman s.n.* (MO); S of Dalby Cass Co.: Hwy 11 E, Cypress Creek, 25 Sep 1948, *Whitehouse* 20291a (BRIT). Harrison Co.: 3.2 mi W of Marshall, 31 Oct 1953, *Shinners* 16766 (BRIT, ISC). Walker Co.: 9 1/2 mi N of Huntsville, 29 Sep 1934, *Cory* 10356 (GH).

***Saccharum brevibarbe* (Michx.) Pers. var. *contortum* (Elliott) R. Webster, comb. nov.** *Erianthus contortus* Elliott, Sketch Bot. S. Carolina 1:40. 1816. *Saccharum contortum* (Elliott) Nutt., Gen. Pl. 1:60. 1818. *Erianthus alopecuroides* (L.) Elliott var. *contortus* (Elliott) Chapm., Fl. South. U.S. 582. 1860. *Erianthus saccharoides* Michx. subsp. *contortus* (Elliott) Hack., Monogr. Phan. 6:131. 1860. TYPE: GEORGIA, *Baldwin s.n.*

Calamagrostis rubra Bosc ex Kunth, Enum. Pl. 1:478. 1833 (fide Hitchcock 1950).

Erianthus smallii Nash, N.Y. Bot. Gard. Bull. 1:429. 1900. TYPE: GEORGIA, *Small s.n.* (HOLOTYPE: NY!).

Lemma of upper floret bifid. Lateral lobes of upper lemma 2–2.5 mm long. Awn of upper lemma 15–22 mm long. Awn of upper lemma basally spiraled (typically with 2–4 complete spirals).

Representative specimens examined. ALABAMA: Barbour Co.: 20 Oct 1943, *Koepper, Justice and Isely s.n.* (NY). Cherokee Co.: 2 mi E Leesburg on US 431, 14 Sep 1968, *Kral* 33378 (BRIT, C). Clay Co.: jct Ala. 77 and 49 near Mellow Valley, 13 Sep 1968, *Kral* 33422 (BRIT). Cleburne Co.: 1 mi E Piedmont on cty 70, 16 Sep 1971, *Kral* 44175 (MO). Cullman Co.: 12 Sep 1897, *Eggert s.n.* (MO, US); N Johnson, 24 Sep 1898, *Eggert s.n.* (BM, MO). Greene Co.: NE Eutaw on Ala 14 toward Clinton, 8 Oct 1968, *Kral* 33894 (MO); Ala. 69, 4.6 mi N Greensboro, 20 Sep 1971, *Kral* 44451 (NY). Lee Co.: Auburn, 25 Aug 1897, *Baker* 1090 (NY); Auburn, 10 Sep 1897, *Earle & Baker s.n.* (NY); Auburn, 14 Oct 1900, *Earle s.n.* (NY). Macon Co.: 4 mi E of Tuskegee, 14 Aug 1927, *Wiegand & Manning*

124 (GH). Marion Co.: 8 mi N of Haleyville on Ala. 5, 6 Oct 1967, *Kral* 29478 (BRIT). Mobile Co.: W of open Pine barrens, Sep 1876, *Mobr s.n.* (US). Montgomery Co.: Montgomery, 19 Oct 1943, *Isely* 2979 (ISC, NY); Montgomery, Feb 1890, *McCarthy* 1888 (GH, MICH, PH). Shelby Co.: 4 mi N jct Ala 25 and Calera, 4 Oct 1968, *Kral* 33585 (BRIT). Tuscaloosa Co.: 12 Oct 1966, *Deramus, Johnson & N Augle* 902 (GH); in Hurricane Creek, 24 Oct 1908, *Harper* 137 (F, GH, MO, NY); 15 mi SW of Tuscaloosa along Hwy 59, 20 Aug 1981, *Hatch* 4607 (MO). **ARKANSAS:** Calhoun Co.: small bottoms, 20 Oct 1941, *Demaree* 22687 (BRIT, US). Drew Co.: P.O. Monticello, 12 Sep 1936, *Demaree* 13688 (BRIT); meandering stream bottoms, P.O. Plantersville, 30 Sep 1937, *Demaree* 16410 (BRIT, MO, NY); low waste meadows, P.O. Monticello, 8 Oct 1938, *Demaree* 18512 (BRIT, ISC, MO, US). Grant Co.: small creek bottoms P.O. Sheridan, *Demaree* 16548 (BRIT, MO). Logan Co.: Magazine Mt., Sep 1947, *Moore* 470657 (US). Nevada Co.: P.O. Prescott, 6 Oct 1940, *Demaree* 21744 (BRIT, GH, ISC, MO). Pike Co.: prairie creek Murfreesboro, 13 Oct 1932, *Demaree* 9689 (BRIT, MO). Pulaski Co.: Pulaski Hts. Little Rock, 15 Sep 1931, *Demaree* 8165 (BRIT, MO, NY); W of Little Rock, Sep 1835, *Engelmann s.n.* (MO). Yell Co.: P.O. Aly, 19 Sep 1970, *Demaree* 62853 (BRIT). **DELAWARE:** 1 mi NW of Georgetown, 13 Sep 1936, *Fogg, Jr.* 11469 (GH, PH). **FLORIDA:** Jefferson Co.: 5 mi W of Monticello, 10 Oct 1957, *Kral* 6164 (GH). Leon Co.: near Tallahassee, *Berg s.n.* (NY); frequent in open pine-grassland, 14 Oct 1974, *Godfrey* 74002 (BM); 7 mi E of Concord, 7 Oct 1956, *Kral* 3609 (GH). **GEORGIA:** Bartow Co.: 4.8 mi E35 degree's of Adairsville, 18 Sep 1951, *Duncan* 13140 (GH). Columbia Co.: above Little Kickee Creek, 24 Apr 1936, *Leeds & Harper* 2770 (PH, US). De Kalb Co.: Stone Mountain, 16 Oct 1907, *Chase* 4520 (ISC, US); Stone Mountain, Aug 1905, *Hitchcock s.n.* (US). Elbert Co.: ca 1.5 mi S of Coldwater Creek, 10 Oct 1979, *Credle* 2649 (NY); Atlanta, 21 Sep 1895, *Lippincott* 129 (PH). Gwinnett Co.: near Mcquire's Mill, 20 Jul 1893, *Small s.n.* (NY, US). Jackson Co.: 11 mi N of Athens, 21 Sep 1947, *Cronquist* 4736 (BRIT, GH, PH, US). Jasper Co.: Monticello, Jul 1846, *Porter s.n.* (MO). Hall Co.: near Gainesville, 21 Aug 1936, *Correll* 6613 (GH). Muscogee Co.: moist, sandy soil, Columbus, 7 Sep 1899, 3858b (US). Oglethorpe Co.: 9.3 mi N 45 degree E of Lexington, 23 Sep 1967, *Blake* 944 (PH). Putnam Co.: near Rock Eagle Lake, 30 Sep 1947, *Cronquist* 4763 (GH, NY). Rockdale Co.: 6 mi SW of Logansville, 18 Oct 1936, *Pyron & McV Augh* 1118 (US). Wilkes Co.: 9.3 mi S 60 degree E of Washington, 16 Oct 1949, *Duncan* 10634 (BM). **LOUISIANA:** Bienville Parish: roadside near Driskill Mtn., 27 Jul 1955, *Moore* 6252 (US); highway 507 near Driskill Mountain, 17 Oct 1987, *Thomas* 102,917 (NY). Bossier Parish: 3 mi NE of Alden Bridge, 7 Aug 1938, *Correll* 10129 (F, NY). Caddo Parish: 4.7 mi SW of Greenwood, 14 Jul 1955, *Shinners* 20740 (BRIT). Caldwell Parish: 3 mi SW of Grayson, 7 Oct 1955, *Shinners* 21884 (BRIT, GH). De Soto Parish: 2 mi W of Hunter, 10 Aug 1938, *Correll* 10183 (GH, US); 4 mi SW of Mansfield, 2 Sep 1967, *Thieret* 27341 (US). Jackson Parish: 2 mi S of Ansley, 6 Sep 1955, *Shinners* 21263 (BRIT, GH). St. Helena Parish: 3 mi NW of Greensburg, 25 Sep 1966, *Thieret* 24873 (US). Ouachita Parish: 10 mi SW of Monroe, 1 Oct 1941, *Smith s.n.* (GH); Sec. 6, T19N, R1E, 18 Sep 1987, *Thomas* 101,981 (NY). **MARYLAND:** Dorchester Co.: near Cambridge, Fork Neck Rd., 7 Oct 1989, *Coben* 1 (US). Somerset Co.: Costen Station, 16 Oct 1935, *Fernald, Long & Fog* 5575 (GH, PH); Princes Anne, Sep 1866, *Canby s.n.* (NY, PH). Wicomico Co.: Rt. 313, 2.9 mi S of Rt. 348, Sharptown, 12 Oct 1981, *Hill & Riefner* 10851 (GH, NY); 0.2 mi W of Walston, 2 Oct 1983, *Hill* 13280 (GH, NY). Worcester Co.: Snow Hill, 30 Sep 1931, *Moldenke* 6591 (NY, US). **MISSISSIPPI:** Greene Co.: near US. 13, 3.7 mi NW of Jason, *Radford* 40346 (C). Harrison Co.: Biloxi, 27 Oct 1893, *Tracy* 2227 (US); Biloxi 9 Oct 1898, *Tracy* 4670 (NY). Jasper Co.: 6 mi via rd. from Enterprise along Souinlovey Creek, 8 Sep 1967 *Jones* 15150 (US). Leake Co.: Natchez

Trace Pkwy, 14 Sep 1947, *McDougall* 1494 (US). Lowndes Co.: Starkville, 12 Oct 1907, *Chase* 4462 (US); Starkville, 22 Oct 1893, *Tracy s.n.* (US); Starkville, 6 Oct 1895, *Tracy s.n.* (NY); Starkville, 4 Oct 1890, *Tracy s.n.* (NY); pine lands Columbus, 28 Sep 1900, *5858d* (US). Tishomingo Co.: 20 mi NW of Iuka, 12 Oct 1956, *Ray, Jr.* 7559 (GH). Wayne Co.: Waynesboro, 8 Aug 1896, *Pollard* 1247 (GH, MO, US). **NORTH CAROLINA:** Anson Co.: open dry hillside near Polkton, 25 Oct 1936, *Correll* 7102 (MICH, US). Beaufort Co.: 5 mi E of Washington, Hwy 264, 10 Oct 1936, *Blomquist* 8000 (NY). Bertie Co.: near Windsor, 15 Oct 1938, *Godfrey* 7002 (GH). Craven Co.: 6.8 mi SE. of New Bern, 10 Sep 1958 *Radford* 40150 (NY). Halifax Co.: Scotland Neck, 15 Oct 1938, *Godfrey* 7019 (GH). New Hanover Co.: Carolina Beach, 30 Aug 1938, *Godfrey* 6376 (US). Harnett Co.: near Angier, 15 Aug 1932, *Blomquist s.n.* (F); 2 mi N of Pine View Station, 29 Feb 1940, *Walker* 1412 (PH). Hyde Co.: near Leechville, 13 Oct 1938, *Godfrey & White* 6862 (GH). Lee Co.: pine woodland near Sanford, 14 Oct 1938, *Godfrey* 6921 (GH); 3.8 mi S of Harnett–Lee county line on NC 87, 29 Sep 1956, *Laing* 351 (US). Stokes Co.: 2.5 mi NE of Walnut Cove, 2 Oct 1958, *Radford* 41284 (BRIT). Pamlico Co.: near Grantsboro, 13 Oct 1938, *Godfrey & White* 6803 (GH). Pitt Co.: 6 mi E of Greenville, Hwy 264, 11 Oct 1936, *Blomquist* 8113 (PH). Polk Co.: 1 mi E of Columbus, 16 Oct 1953, *Freeman* 53589 (US). Tyrrell Co.: along rt. 64, 3.8 mi E of Columbia, 22 Oct 1970, *Terrell* 4364 (US); 1.4 mi E of Columbia, along rt. 64, 22 Oct 1970, *Terrell* 4365 (US). Wake Co.: Raleigh, 7–25–1930, *Blomquist* 44 (US); Raleigh, 10 Sep 1938, *Godfrey* 6600 (GH). **OKLAHOMA:** Leflore Co.: 20 mi N of Broken Bow, 16 Oct 1937, *Hopkins & Cross* 2493 (US); 2.5 mi E of Page, 13 Oct 1948, *Robbins* 3201 (BRIT, NY); 7 mi E of Broken Bow, 28 Aug 1938, *Smith* 502 (MO); 12 mi N of Bethel, 14 Oct 1951, *Waterfall* 10505 (US). **SOUTH CAROLINA:** Aiken Co.: Oct 1889, *Ravenel s.n.* (US). Anderson Co.: Anderson, 2 Sep 1919, *Davis* 1280 (F); Anderson, 26 Aug 1921, *Davis* 2063 (BM, MO); Anderson, 14 Sep 1919, *Davis* 9109 (BM); Anderson, 5 Oct 1920, *Davis s.n.* (US); McKinney Springs, 8 Sep 1917, *Davis s.n.* (MO); between Pendleton Place apts. and landfill entrance gate, 13 Sep 1987, *Hill* 18791 (GH, NY). Florence Co.: jct of S.C. 237 and US 52, 17 Oct 1968, *Leonard & Radford* 2149 (MO). Greenwood Co.: Bradley, Sep 1920, *Davis s.n.* (BM). McCormick Co.: 6 mi SW of McCormick, 18 Sep 1949, *Duncan* 10395 (US); 6 mi SE of Clarks Hill, 13 Oct 1957, *Radford* 30638 (GH). Oconee Co.: 1 Oct 1897, *Anderson* 1426 (GH, US). Orangeburg Co.: 16 Aug 1905, *Hitchcock* 234 (BM, C, F, GH, NY, PH, US). Union Co.: Carlisle, 11 Jul 1906, *House* 2478 (US). **TENNESSEE:** Hardin Co.: ca. 15 mi SE Maddox, 13 Sep 1971, *Kral* 43905 (MO). Polk Co.: Hiwassee Valley, 30 Sep 1893, *Ruth s.n.* (US); Hiwassee River, Aug 1895, *Ruth s.n.* (MO); Hiwassee River, Aug 1894, *Ruth s.n.* (NY). McNairy Co.: Pine–oak forest W of Ramer., 16 Oct 1949, *Woods* 14654 (US). **TEXAS:** Bowie Co.: Springs, 20 Oct 1961, *Correll & Correll* 24771 (GH). Camp Co.: Pittsburg, 13 Sep 1923, *Tharp* 1970 (US). Gregg Co.: 27 Sep 1941, *York s.n.* (GH, MO). Henderson Co.: 3 mi E of Athens, 9 Nov 1962, *Correll* 26699 (MO). Hopkins Co.: 7.8 mi S of Sulphur Springs, 11 Sep 1949, *Turner* 1419 (BRIT). Houston Co.: 3 mi SE of rt. 21, 1 Dec 1962, *Correll* 26906 (NY). Leon Co.: 1/4 mi E of Keechi, 5 Oct 1937, *Cory* 25229 (US). Morris Co.: 2 mi W of Omaha, 17 Oct 1962, *Correll* 26317 (NY). Rusk Co.: Texas, 1884, *Nealley s.n.* (US). Smith Co.: western Tyler, N of Pine Burr Road, 18 Aug 1949, *Cory* 56858 (BRIT, US); 8 mi NE of Tyler, 10 Oct 1943, *Moore, Jr.* 545 (GH, US); glades in oak–hickory woods Amigo, 14 Oct 1945, *Moore Jr.* 1053 (BM, C, F, GH, ISC, MICH, NY, PH, US); near Gumwood, 27 Sep 1926, *Palmer* 31751 (US). Titus Co.: 6 mi SW of Mt. Pleasant, 23 Sep 1971, *Amerson* 733 (BRIT). Upshur Co.: 3.3 mi S of New Diana, 15 Sep 1953, *Shinners* 16020 (BRIT, ISC). **VIRGINIA:** Norfolk Co.: near Norfolk, 10 Nov 1890, *Blanchard s.n.* (F); 19 Jul 1898, *Kearney* 1741 (US); Virginia Beach, 22 Sep 1900, *Williams* 3112 (GH, US). Accomack

Co.: Oak Hall, 16 Oct 1935, *Fernald, Long & Fogg, Jr.* 5576 (GH, PH); 1882, *Mears s.n.* (US). Charles City Co.: near Malvin Hill, 26 Sep 1936, *Erlanson* 134 (US); near Malvin Hill, 26 Sep 1936, *Erlanson* 163 (US). Henrico Co.: W of Elko Station, 21 Sep 1938, *Fernald & Long* 9243 (F, GH, PH); Richmond, 1876, *Wood et al* 2309 (US). Greensville Co.: E of Slagle's Pond, N of Emporia, 20 Sep 1938, *Fernald & Long* 9245 (GH, PH). Isle of Wight Co.: N of Windsor, 13 Jul 1938, *Fernald & Long* 8580 (GH, PH). James City Co.: 20 mi W of Williamsburg, Highway 60, 31 Aug 1956, *Meyer s.n.* (MO). Nansemond Co.: Factory Hill, 26 Aug 1936, *Fernald & Long* 6457 (GH, PH); 2 mi SE of Cleopus, 15 Oct 1938, *Fernald & Long* 9507 (GH, MICH, PH, US); Portsmouth, 9 Sep 1895, *Noys* 48 (US). Norfolk Co.: near Ocean View, 11 Nov 1898, *Kearney, Jr.* 2398 (US). Northampton Co.: Meadows, 10 Oct 1891, *Canby s.n.* (NY); Belle Haven, 8 Sep 1935, *Fogg, Jr.*, 9726 (GH, PH). Southampton Co.: Swale, Courtland, 11 Sep 1937, *Fernald & Long* 7302 (GH, PH).

***Saccharum coarctatum* (Fern.) R. Webster, comb. nov.** *Erianthus coarctatus* Fernald, *Rhodora* 45:246. pl. 758. 1943. TYPE: VIRGINIA, *Fernald & Long* 7301 (HOLOTYPE: US!). Fig. 4.

Erianthus coarctatus var. *elliottianus* Fernald, *Rhodora* 45:246. 1943. TYPE: FLORIDA, *Curtiss* 6940 (HOLOTYPE: US!).

Rhizomes with compacted nodes. Flowering culms 10–25 dm tall. Nodes hairy (the hairs ca. 1–3 mm long). Internodes spongy or hollow. Leaves with sheath auricles. Auricles 0.3–1 mm long. Sheaths not ciliate. Ligule 1–2 mm long. Collar differentiated or not; glabrous or hairy. Leaf blades 15–40 cm long; 7–12 mm wide; glabrous. Peduncle 35–45 cm long; glabrous. Inflorescence linear or oblong; 30–70 mm wide. Lowermost inflorescence node smooth. Main axis 13–35 cm long; glabrous or sparsely hairy; pilose. Primary branches appressed to the main axis; 5–12 cm long; hairy; ciliate. Rachis internode 3–6 mm long; 0.3–0.4 mm wide; hairy. Pedicels 3–5 mm long; hairy. Callus hairy. Callus hairs white or straw-colored hairs; 3–5 mm long; shorter than the spikelet. Spikelets homomorphic or heteromorphic; brown; 6–8 mm long; 0.9–1.2 mm wide. First glume 5-nerved; smooth or scabrous. Second glume 3-nerved. Lemma of lower floret 5.8–7.5 mm long; 3-nerved. Upper floret 0.7–0.8 times the length of the lower floret. Lemma of upper floret 4–5.5 mm long; 3-nerved; entire. Awn of upper lemma mostly 16–26 mm long; basally terete; not basally spiraled. Lodicules with nerves extending into hair-like projections.

Saccharum coarctatum is common on the coastal plain of the southeastern United States from Louisiana to Florida and north to Delaware. Species such as *S. alopecuroideum*, *S. giganteum*, and *S. brevibarbe* occur commonly in the central part of the southeast. *Saccharum coarctatum* is restricted to the lower elevations of the sandy coastal plain. Its northern geographic limit is southern Louisiana, Mississippi, Alabama, Florida, and Georgia. On the east coast it is common in eastern Georgia, South Carolina, North Carolina, Virginia, Maryland, and Delaware. *Saccharum coarctatum* prefers open, moist, and loamy habitats, which are seasonally flooded. Diagnostic veg-

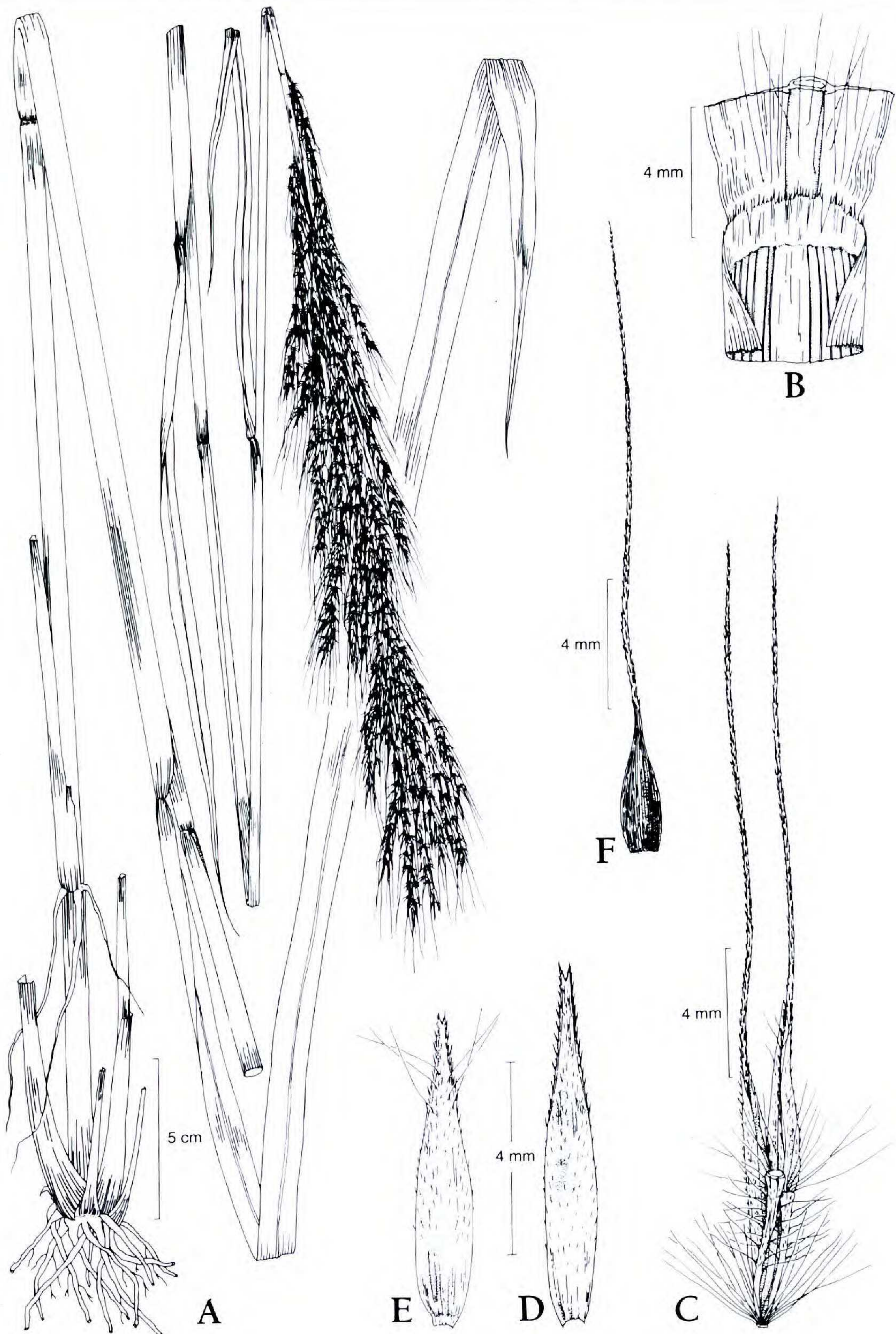


FIG. 4. *Saccharum coarctatum*. A. Habit, B. Ligule, C. Spikelet Pair, D. First Glume, E. Second Glume, F. Upper Lemma and Awn.

etative characters for *S. coarctatum* include relatively narrow leaf blades, narrow culm internodes, and essentially glabrous culms. These features are similar to those of *S. baldwinii*, which is best separated from *S. coarctatum* on the presence of hairy nodes; however, the nodes of *S. coarctatum* frequently become glabrous at maturity. The most reliable distinguishing characters for *S. coarctatum* are the straight non-spiraled awn of the upper lemma and callus hairs that are about half the length of the spikelet. An interesting characteristic of this species is that the nerves of the lodicules extend into hair-like projections that measure about 0.6 mm long.

Fernald (1943) described the taxon, *Erianthus coarctatus* var. *elliottianus* Fern. and distinguished it from the typical variety on the basis of its relatively wider culm internodes, higher culm height, wider leaf blades, longer inflorescence main axis, and a wider inflorescence. When the variation among all specimens is considered, these characters intergrade with the typical variety. Therefore, no formal taxonomic rank was given to these somewhat larger specimens.

Representative specimens examined. **ALABAMA:** Covington Co.: pine savanna 9.5 mi S Opp., 5 Oct 1968, *Kral* 33679 (MO). Escambia Co.: 0.5 mi E Canoe, 7 Oct 1968, *Kral* 33888 (MO). Mobile Co.: 10.7 mi S Theodore on Ala. 59, 8 Oct 1967, *Kral* 29731 (US). **DELAWARE:** Sussex Co.: dry sandy soil, Sep 1894, *Canby s.n.* (PH); 5 mi W of Milledale on road to Laurel, 12 Oct 1898, *Canby, Sargent & Muir s.n.* (PH). Ellendale, 25 Sep 1873, *Commons s.n.* (NY, PH, US); fencerow, 1/4 mi E of Ellendale, 12 Oct 1940, *Tatnall* 4745 (GH, PH); few mi W of Ellendale, 06 Nov 1961, *Terrell & Thornton* 3625 (US). **FLORIDA:** Alachua Co.: 3 mi W of Gainesville, 5 Nov 1938, *Swallen* 5565 (US). Suwannee Co.: Live Oak, 9–17–1900, *Curtiss* 3858 (US); near Live Oak, 10 Oct 1901, *Curtiss* 6940 (NY, US). Union Co.: W of Lake Butler, 26 Oct 1940, *Silvens* 6746 (US). **GEORGIA:** Berrien Co.: base of sand-hills of Little River, SW of Tifton, 29 Sep 1902, *Harper* 1693 (BM, GH, MO, NY, US). McIntosh Co.: 2.3 mi W of S tip of Blackbeard Island, 17 Oct 1956, *Duncan* 20662 (ISC, US). Tift Co.: Brookfield, 9–1978, *Quarin* 3605 (C, MO). **LOUISIANA:** Calcasieu Parish: Oberlin, 8 Sep 1898, *Ball* 194 (NY, US). Rapides Parish: Alexandria, *Hale s.n.* (PH). **MARYLAND:** Dorchester Co.: Robinson's Neck, Taylor's Island, Oct 1979, *Reese s.n.* (US). Somerset Co.: 5 mi N of Princess Anne, 2 Oct 1937, *Tatnall* 3574 (GH, PH). Wicomico Co.: 3 mi SW of Salisbury, 4 Sep 1937, *Wilkins* 5364 (PH). **NORTH CAROLINA:** Brunswick Co.: S of Wilmington, 8 Oct 1933, *Blomquist* 721 (NY); Wilmington, 8–1905, *Hitchcock s.n.* (US). Columbus Co.: old Dock, 8–29–1938, *Godfrey* 6339 (GH, US). Duplin Co.: between Faison and Warsaw, 5 Oct 1935, *Correll & Blomquist* 4823 (GH, US). Johnston Co.: between Clayton and Smithfield, 2 Sep 1932, *Blomquist* 333 (F, US). Robeson Co.: 5.1 mi SW of St. Pauls, 18 Oct 1958, *Britt* 2851 (MICH). **SOUTH CAROLINA:** Georgetown Co.: 5 mi S of Andrews, 11 Sep 1939, *Godfrey* 8191 (F, GH, MO, NY, PH, US); 5 mi N of Georgetown, 15 Sep 1939, *Godfrey & Tryon* 8229 (GH, US). Sumter Co.: 5 mi E of Sumter, 4 Oct 1957, *Radford* 29591 (GH, NY). **VIRGINIA:** Sussex Co.: 4 mi NW of Homerville, 20 Sep 1937, *Fernald & Long* 7301 (F, PH); NW of Owen's Store, 14 Oct 1941, *Fernald & Long* 13884 (GH, PH).

Saccharum giganteum (Walt.) Pers., Syn. Pl. 1:103. 1805. *Anthoxanthum giganteum* Walt., Fl. Carol. 65. 1788. *Erianthus saccharoides* Michx., Fl. Bor.-Amer.

1:55. 1803, *nom. illeg.* *Erianthus giganteus* (Walt.) C. E. Hubb., *Rhodora* 14:166. 1912, *non Muhlent.* 1813. *Saccharum erianthoides* Raspail, *Ann. Sci. Nat., Bot.* 5:308. 1825, *nom. illeg.* *Andropogon erianthus* Link, *Hort. Berol.* 1:243. 1827, *nom. illeg.* TYPE: SOUTH CAROLINA. Georgetown Co.: *Godfrey* 8192 (NEOTYPE: MO, here designated). Fig. 5.

Erianthus saccharoides Michx. var. *michauxii* Hack., in *Mart., Fl. Bras.* 2:57. 1883 (fide Hitchcock 1951).

Erianthus laxus Nash, *Bull. Torrey Bot. Club* 24:344. 1897. TYPE: FLORIDA. Paola, *Swingle* 1732a (HOLOTYPE: NY!).

Erianthus compactus Nash, *Bull. Torrey Bot. Club* 22:419. 1895. *Erianthus saccharoides* Michx. var. *compactus* (Nash) Fernald, *Rhodora* 45:252. 1943. TYPE: Washington, D.C., *Nash s.n.* (HOLOTYPE: NY!).

Rhizomes with compacted nodes. Flowering culms mostly 10–25 dm tall. Nodes hairy (the hairs ca. 5 mm long). Internodes hollow. Leaves without auricles. Sheaths ciliate at the apex. Ligule 2–6 mm long. Collar differentiated; hairy. Leaf blades mostly 35–70 cm long; 8–30 mm wide; hairy on the upper surface. Peduncle mostly 40–80 cm long; hairy (pilose). Inflorescence oblong or lanceolate; 6–15 cm wide. Lowermost inflorescence node differentiated; densely hairy. Main axis mostly 15–30 cm long; hairy; pilose; densely or sparsely hairy. Primary branches appressed to the main axis (spreading at anthesis); 2–13 cm long; hairy; ciliate. Rachis internode 2–5.5 mm long; about 0.3 mm wide; hairy. Pedicels 2.5–5.0 mm long; hairy. Callus hairy. Callus hairs straw-colored or brown; 7–25 mm long (mostly 15–20); longer than the spikelet. Spikelets heteromorphic (the lower spikelet commonly glabrous and the upper spikelet pilose); straw-colored; 4.2–6 mm long; 0.8–1.1 mm wide. First glume indistinctly 5-nerved; smooth. Second glume indistinctly 3 or 5-nerved. Lemma of lower floret 3–5 mm long; nerveless. Upper floret subequal to the lower floret. Lemma of upper floret 2.5–3.5 mm long; 1-nerved; entire. Awn of upper lemma usually 12–26 mm long; basally terete; not basally spiraled. Lodicules with nerves extending or not extending into hair-like projections.

Saccharum giganteum is a polymorphic species that occurs throughout the southeastern United States and extends into Central America where its morphological relationship with *S. trinii* (Hack.) Renv. is unclear. In North America its western limit is the savannas and prairies of east Texas, and its northern limit is Arkansas through Tennessee to southern Pennsylvania and New Jersey. Within this complex, *S. giganteum* is distinguished by the presence of a straight upper lemma awn and callus hairs longer than the spikelet. It is most similar to *S. alopecuroideum*, and intermediate specimens are occasionally encountered. *Saccharum giganteum* commonly exists in a variety of ecological conditions ranging from standing water and loamy soils to dry red clay on open hillsides. It prefers open marshy conditions

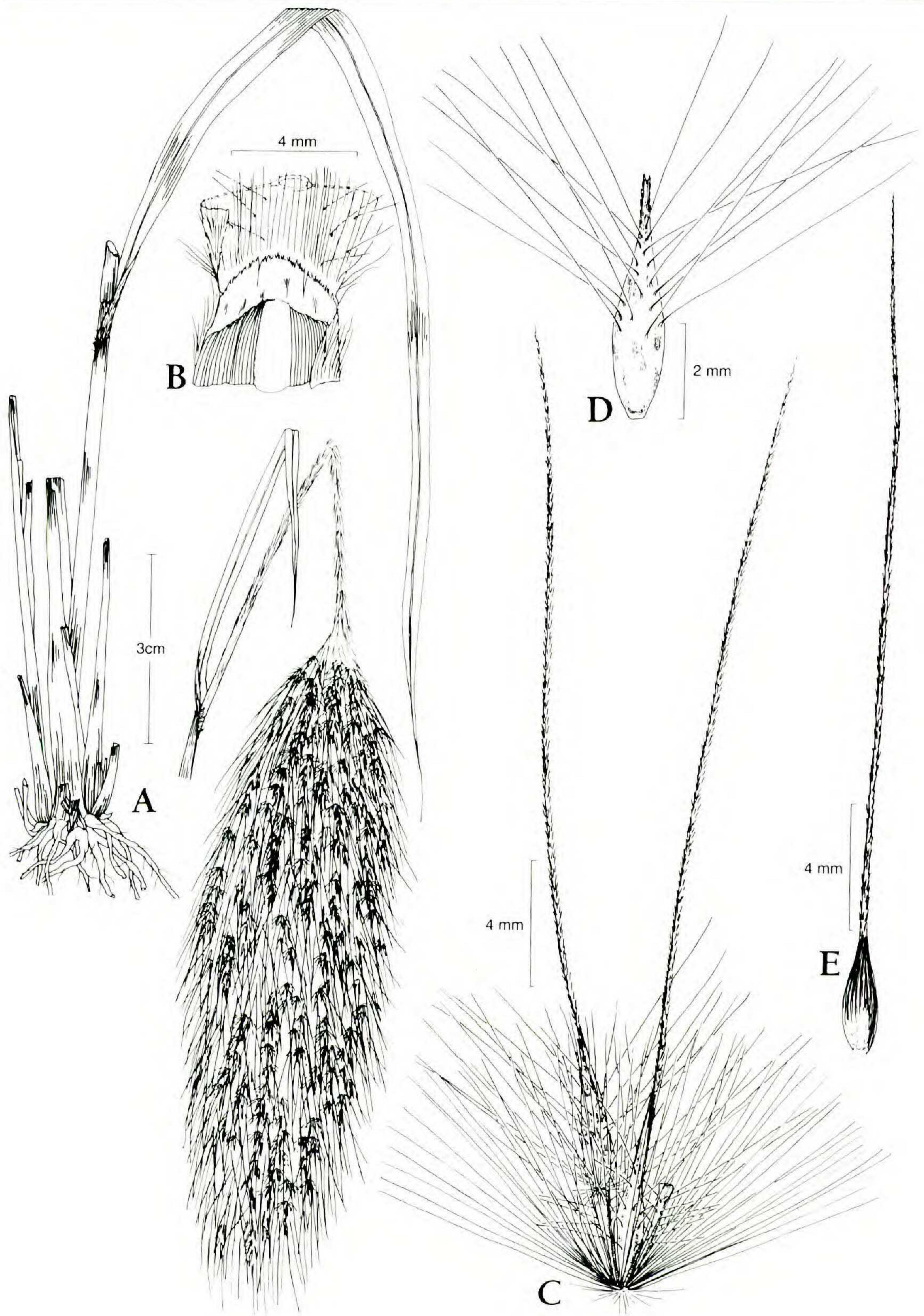


FIG. 5. *Saccharum giganteum*. A. Habit, B. Ligule, C. Spikelet Pair, D. First Glume, E. Upper Lemma and Awn.

where it frequently grows to 2.5 m. in height with large, bushy inflorescences. It is also common in the clay pineland savannas of northern Florida and southern Mississippi, where it may be only a meter in height with a relatively small compacted inflorescence.

Nash (1913) recognized three taxa that Hitchcock (1951) placed in synonymy. Nash separated *E. laxus* from *E. saccharoides* (= *S. giganteum*) on the basis of elongate primary branches, longer rachis internodes, and longer basal hairs. These characters and others exhibited by the type specimen cannot be used to differentiate *E. laxus* from the typical form; therefore, the name *E. laxus* was placed in synonymy. Nash delimited *E. compactus* on the basis of a compact panicle with short branches, short rachis internodes, and crowded small spikelets. These characters cannot be used in a consistent manner. Many of the specimens with these characteristics also exhibit evidence of seasonal burning, mowing, or growth in less than favorable habitats. It was suspected that these smaller plants with compacted inflorescences, which are common in Delaware and New Jersey, are the result of the above negative growth factors and *E. compactus* was placed as a synonym. Nash's *E. tracyii* poses a different problem. The type specimen has a densely pilose inflorescence with long white callus hairs and the awn of the upper lemma is spiraled at the base. Based on the presence of the spiraled awn, *E. tracyii* was placed as a synonym of *S. alopecuroides*. Other specimens [Pollard 1341 (NY), Kearney 6 (PH, NY), Tracy 5332 (NY)], collected near Starkville, Mississippi in the fall of 1896 are similar to the type of *E. tracyii* but possess a short straight awn. These specimens appear similar to the South American species, *S. trinii*. It seems possible that *S. trinii* was introduced at the agricultural station at Starkville, escaped, collected, and since disappeared. Future studies of the variation in the South American species may show that *S. trinii* may rarely occur in southern Florida.

Representative specimens examined. **ALABAMA:** Autauga Co.: 2 mi NE of Autaugaville, 24 Sep 1934, Harper 3272 (GH, PH). Cullman Co.: 17 Sep 1897, Eggert s.n. (GH, NY). Escambia Co.: 2 mi W of Brewton, 6 Oct 1968, Kral 33730 (BRIT). Geneva Co.: 4 mi W of Geneva on county 4, 6 Oct 1958, Kral 22771 (BRIT). Mobile Co.: 1 mi N Mt. Vernon, 7 Oct 1967, Kral 29520B (BRIT). **ARKANSAS:** Ashley Co.: Wilson Lake, 11 Oct 1936, Demaree 13892 (BRIT, GH, NY). Bradley Co.: Drew and Bradley Co. line, 5 Oct 1940, Demaree 21822 (BRIT, GH, MO, NY). Calhoun Co.: P.O. Tinsman, 20 Oct 1941, Demaree 22688 (BRIT, NY). Columbia Co.: P.O. Magnolia 6 Oct 1940, Demaree 21785 (BRIT, NY). Crittenden Co.: P.O. W of Memphis, 3 Oct 1969, Demaree 61271 (BRIT). Phillips Co.: P.O. W of Helena, 15 Oct 1950, Demaree 30246 (BRIT). **DELAWARE:** New Castle Co.: 1 1/2 mi SW toward Vandyke, 20 Sep 1907, Van Pelt s.n. (PH). Sussex Co.: 1.3 mi N of Bethany Beach, 12 Oct 1940, Chase 12626 (MICH). **DISTRICT OF COLUMBIA:** Brightwood, 7 Oct 1905, Hitchcock 235 (GH). **FLORIDA:** Brevard Co.: Okeechobee region, 22 Sep 1903, Fredholm 6017 (GH). Calhoun Co.: near Jacksonville, Curtiss 3627 (MICH). Dade Co.: SW of Homestead, 12 Oct 1962, Craighead 9228

(GH). Dixie Co.: 4 mi N of Suwannee, 12 Oct 1957, *Godfrey* 56180 (GH, NY). Duval Co.: Ft. Caroline and Merrill Roads, *F. C. & Greager* 282 (GH). Hamilton Co.: 1.2 mi WNW of Jennings–Blue Springs exit Hwy I–75, 13 Nov 1970, *Tbigpen* 325 (NY). Lee Co.: Central Sanibel, 6 Oct 1972, *Brumbach* 8046 (GH). Leon Co.: 5 mi N of Tallahassee, 11 Oct 1957, *Godfrey* 56136 (GH). Madison Co.: 7 mi W of Greenville, 2 Oct 1955, *Kral & Gillespie* 53999 (NY). Seminole Co.: Altamonte Springs, 5 Oct 1959, *Schallert* 486 (MICH). **GEORGIA:** Colquit Co.: in small pine–barren stream, 23 Sep 1902, *Harper* 1662 (GH). McIntosh Co.: 5 mi NW of Townsend, 10 Mar 1940, *Walker* 1486 (PH). **LOUISIANA:** Avoyelles Parish: 8 mi S of Bunkie, 17 Sep 1968, *Harvey* 8098 (MICH). Madison Parish: 5.8 mi N of Waverly, 8 Sep 1979, *Rich et al* 1499 (NY). Natchitoches Parish: Sec. 1 T12N R6W, 17 Oct 1986, *Thomas & Gilmore* 98848 (MO, NY). St. Landry Parish: 3.3 mi W of Opelousas, 5 Oct 1956, *Shinners* 25,008 (BRIT). Tensas Parish: 3.7 mi S of La. 4 and Newellton, 1 Oct 1987, *Thomas* 102,260 (NY). **MARYLAND:** Caroline Co.: 1 mi N of Hollingsworth crossroads, 14 Sep 1986, *Hill* 17378 (NY). Dorchester Co.: 11 mi SW of Cambridge, 5 Sep 1937, *Earle* 1636 (GH, PH). Prince Georges Co.: Kenilworth swamp, 24 Sep 1897, *Pieters s.n.* (MICH). Talbot Co.: 2 1/2 mi NE by N of Easton, *Earle* 4774 (GH); 1 1/2 mi WNW of Easton, 17 Sep 1967, *Earle* 5401 (PH). Wicomico Co.: Rt. 50 crossing at Nanticoke River, 12 Oct 1981, *Hill* 10859 (GH). **MISSISSIPPI:** Franklin Co.: 4 mi W of jct Miss. 33 near Leesdale, 25 Sep 1970, *Westmoreland* 707 (F). Pearl River Co.: Picayune, 6 Oct 1964, *Sargent* 8476 (MICH). **NEW JERSEY:** Burlington Co.: Indian Mills, 9 Sep 1922, *Driskirk* 1144 (F, GH, PH). Camden Co.: 1 Sep 1871, *Parker s.n.* (F). Cape May Co.: Ocean City, 14 Sep 1907, *Van Pelt* 1907 (GH, PH). Cumberland Co.: W of Cedarville, 17 Mar 1935, *Long* 45538 (PH). Gloucester Co.: 18 Sep 1868, *Parker s.n.* (GH). Ocean Co.: Forked river, 3 Nov 1937, *Koster* 05-85-2 (MICH). **NORTH CAROLINA:** Anson Co.: near Polkton, 25 Oct 1936, *Correll* 7101 (MICH). Beaufort Co.: Savannah near Edward, 13 Oct 1938, *Godfrey* 6890 (GH). Brunswick Co.: The Oaks, 4 Oct 1941, *Radford* 10110 (NY). Buncombe Co.: near Biltmore, 2 Sep 1938, 5847 (F, GH). Cartaret Co.: 1 Sep–1938, *Godfrey* 6499 (GH). Craven Co.: New Bern, 11 Nov 1903, *E.B.H.* 4177 (GH). Durham Co.: Duke Forest, 20 Oct 1932, *Blomquist* 708 (F). Edgecombe Co.: 3.2 mi S of Battleboro, 23 Sep 1958, *Radford* 40595 (BR). Gates Co.: near Gatesville, 15 Oct 1938, *Godfrey* 7043 (GH). New Hanover Co.: Carolina Beach, 30 Aug 1938, *Godfrey* 6375 (GH). Hoke Co.: 6 mi S of Southern Pines, 25 Oct 1935, *Blomquist* 7176 (MICH). Hyde Co.: near Leechville, 13 Oct 1938, *Godfrey & White* 6863 (GH). Macon Co.: near Franklin, 10 Sep 1933, *Alexander et al s.n.* (NY). Nash Co.: Pineland at Middlesex, 9 Oct 1938, *Godfrey & Kerr* 6616 (GH). Pamlico Co.: roadside near Grantaboro, 13 Oct 1938, *Godfrey & White* 6820 (GH). Pitt Co.: 1.5 mi sec. of Stokes, 9 Oct 1958, *Radford* 41756 (NY). Swain Co.: Smoke Mountains, 20 Aug 1891, *Beardslee & Kofoid s.n.* (GH). Wake Co.: sphagnum bog at Method, 10 Oct 1938, *Godfrey* 6730 (GH). Wilson Co.: near US. 264, 3 mi W of Sims, 25 Sep 1958, *Radford* 40709 (MICH). **PENNSYLVANIA:** Bucks Co.: bank of Delaware river, *Martindale s.n.* (GH). **SOUTH CAROLINA:** Berkeley Co.: Swale, St. Stephens, 15 Sep 1939, *Godfrey* 8199 (GH). Georgetown Co.: 5 mi S of Andrews, *Godfrey* 8192 (GH, MO). Jasper Co.: 4 mi NNW of Hardeeville, 12 Oct 1974, *Boufford* 15848 (GH). Lee Co.: 4 mi WSW of Ashland, 3 Oct 1957, *Radford* 29301 (GH). Williamsburg Co.: 5.4 mi ene of Kingstree, 19 Oct 1957, *Radford* 31233 (BRIT). **TENNESSEE:** Sumner Co.: pond near Mitchelville, Aug 1886, *Gattinger s.n.* (GH). Tipton Co.: 9.7 mi SW of Covington, 23 Oct 1958, *Shinners* 27,674 (BRIT). **TEXAS:** Brazoria Co.: 3 mi N of F. M. 2004, 28 Oct 1974, *Waller & Bauml* 3293 (GH). Cass Co.: 2 mi SW of Linden, 18 Oct 1962, *Correll* 26424 (MO). Galveston Co.: 3/4 mi E I. H. 45, N of Dickinson, 18 Nov 1974, *Waller & Bauml* 3301 (GH). Gonzales Co.: Palmetto State Park, 3 Oct 1943, *Barkley* 13697 (BRIT, GH, NY,

PH). Henderson Co.: 2 mi SE of Athens, 12 Oct 1962, *Correll* 26187 (NY). Jasper Co.: 2 mi W of McGee Bend Dam., 13 Nov 1963, *Correll* 28644 (NY). Milam Co.: 4 mi NW of Milano, 30 Oct 1933, *Wolff* 4873 (BRIT). Orange Co.: 6 1/2 mi W of Orange, 16 Nov 1945, *Cory* 50885 (BRIT, MICH). San Augustine Co.: Boykin Spring Camp, E of Zavalla, 19 Sep 1952, *Gould & Leinweber* 6544 (BRIT). Wood Co.: near Little Hope, E. of Quitman, 19 Jan 1979, *Gritz* 102 (BRIT). VIRGINIA: Campbell Co.: 3/4 mi W of Waterlick road, 28 Sep 1947, *Freer* 1913 (GH). Dinwiddie Co.: 4 mi S of Petersburg, 11 Oct 1938, *Fernald & Long* 9505 (GH). Fairfax Co.: near Fairfax, 21 Sep 1936, *Allard* 2303 (GH, NY); U.S. Highway 50, E of Merrifield, 22 Sep 1939, *Hermann & Martin s.n.* (MICH, NY). Greenville Co.: 1 mi NW of Dahlia, 18 Sep 1938, *Fernald & Long* 9244 (GH). Nansemond Co.: Factory Hill, 26 Aug 1936, *Fernald & Long* 6456 (GH). Prince George Co.: N of Gray Church, 25 Aug 1936, *Fernald & Long* 6455 (GH, PH). Stafford Co.: 1/4 mi E, 3 Sep 1939, *Hermann* 10395 (GH). Southampton Co.: Swale, Courtland, 11 Sep 1937, *Fernald & Long* 7304 (GH, PH). Sussex Co.: NW of Wakefield, 11 Sep 1937, *Fernald & Long* 7303 (GH).

REFERENCES

- ALLEN, C.M. 1975. Grasses of Louisiana. University of Southwestern Louisiana, Lafayette, Louisiana.
- BOR, N.L. 1960. The grasses of Burma, Ceylon, India and Pakistan. New York: Pergamon Press.
- _____. 1970. Gramineae in Rechinger's Flora Iranica. Akademische Druck Verlagsanstalt, Austria.
- BURKHART, A., J.A. CARO, K.A. OKADA, R.A. PALACIOS, and Z. E. R. AGRASAR. 1969. Flora ilustrada de Entre Rios (Argentina): Part II, Gramineas. Buenos Aires: I.N.T.A. 4.
- BURNER, D. and R.D. WEBSTER. 1994. Cytology of the native North American species of *Saccharum*. *Sida* 16:233–244.
- CHAPMAN, A.W. 1860. Flora of the southeastern United States. Ivison, Phinney & Co. New York.
- CHIPPENDALL, L. 1955. The grasses and pastures of South Africa. Hafner Publishing Co.: New York.
- CLAYTON, W.D. and S. A. RENVOIZE. 1986. Genera graminum: Grasses of the World. Kew, London: Royal Botanical Gardens.
- CORRELL, D.S. and M.C. JOHNSTON. 1970. Manual of the vascular plants of Texas. Texas Research Foundation, Renner, Texas.
- DALLWITZ, M.J. 1980. A general system for coding taxonomic descriptions. *Taxon* 29: 41–46.
- DALLWITZ, M.J., T.A. PAINE, and E.J. ZURCHER. 1993. User's guide to the DELTA system: A general system for processing taxonomic descriptions. 4th ed. CSIRO Division of Entomology: Canberra, Australia.
- DUTT, N.L. and J.T. RAO. 1950. The present taxonomic position of *Saccharum* and its congeners. *Proc. Int. Soc. Sug. Tech.*, VII Congr., Brisbane, 288–293.
- ELLIOTT, S. 1816. A sketch of the botany of South Carolina and Georgia. J. R. Schenck, Charleston, South Carolina.
- FERNALD, M.L. 1943. *Erianthus brevibarbis* Michx. and other species. *Rhodora* 45:246–255.
- _____. 1950. Gray's manual of botany. D. Van Nostrand Co.: New York, New York.
- GANDI, K.N. and B.E. DUTTON. 1993. Palisot de Beauvois, the correct combining author of *Erianthus giganteus* (Poaceae). *Taxon* 42:855–856.

- GODFREY, R.K. and J.W. WOOTEN. 1979. Aquatic and wetland plants of southeastern United States. University of Georgia Press, Athens, Georgia.
- GOULD, F.W. 1975. The grasses of Texas. Texas A&M University Press, College Station, Texas.
- HITCHCOCK, A.S. 1933. Gramineae, In: J.K. Small, Flora southeastern United States. New York: By the author.
- _____. 1935. Manual of the grasses of the United States. Washington, D.C.: U.S. Dept. Agric. Misc. Publ. 200.
- _____. 1951. Manual of the grasses of the United States. 2nd ed. Revised by A. Chase. Washington, D.C., U.S. Dept. Agric. Misc. Publ. 200.
- HSU, C.C. 1978. Gramineae, In: Flora of Taiwan. Epoch Publishing Co.: Taipei, Taiwan. Vol. 5.
- LINNAEUS, C. 1753. Species plantarum. Facsimile ed., Royal Society London, England.
- LONG, R.W. and O. LAKELA. 1971. A flora of tropical Florida. University of Miami Press, Coral Gables, Florida.
- MICHAUX, A. 1803. Flora boreali-Americana. Caroli Crapelet.
- MOHR, C. 1901. Plant life of Alabama. Contr. U.S. Natl. Herb. 6.
- MUHLENBERG, G.H.E. 1813. Cat. Pl. Amer. Sep t. William Hamilton, Lancaster.
- MUKHERJEE, S.K. 1958. Revision of the genus *Erianthus* Michx. (Gramineae). Lloydia, 21:157-188.
- NASH, G. 1903, 1913. Gramineae, In: J. K. Small's flora southeastern United States. New York: By the author.
- NUTTALL, T. 1818. The genera of North American plants. D. Heart, Philadelphia, Pennsylvania.
- PERSOON, C.H. 1805. Synopsis plantarum. Parisiis lutetiorum, Paris.
- RADFORD, A.E., H.E. AHLES and R. BELL. 1964. Manual of the vascular flora of the Carolinas. The University of North Carolina Press, Chapel Hill, North Carolina.
- RENVOIZE, S.A. 1984. The grasses of Bahia. Royal Botanic Gardens, Kew, England.
- ROSENGURTT, B., B. ARRILLAGA DE MAFFEL, and P. IZAGUIRRE DE ARTUCIO. 1970. Gramineas Uruguayas. Universidad de la Republica, Dept. de Publicaciones, Montevideo, Uruguay.
- SMITH, L.B., D.C. WASSHAUSEN, and R.M. KLEIN. 1982. Gramineas in flora ilustrada Catarinense. Smithsonian Institute, Washington, D.C.
- SPRENGEL, K. 1815. Pugillus 2:16.
- SPRENGEL, K. 1825. Systema Vegetabilium 1:282. Gottingae.
- STRAUSBAUGH, P.D. and E.L. CORE. 1970. Flora of West Virginia. Seneca Books, Inc., Grantsville, West Virginia.
- TSVELEV, N.N. 1976. Grasses of the Soviet Union. Academiya Nauk SSSR, Botanicheskiy Institut im. V.L. Komarova. [English translation by Amerind Publishing Co.: New Delhi 1983.]
- WALTER, T. 1788. Flora Caroliniana. J. Fraser, London, England.
- WEBSTER, R.D. 1988. Genera of North America Paniceae (Poaceae:Panicoideae). Sida 13:576-609.
- _____. 1992. Old World genera of the Paniceae (Poaceae:Panicoideae). Sida 15: 9-40.